FEB 4 1924

TELEPHONE ENGINEER

VOLUME 28 JANUARY, 1924 Number 1

Guardians of Service

THE maximum traffic capacity of a Strowger Automatic exchange is available at all times of the day or night. At midnight as well as noon, at 3 A. M. as well as 3 P. M., Strowger Automatic switches are ready to guard against the dangers of unforeseen "peaks."

The ability of Strowger Automatic equipment to render satisfactory service during emergencies as well as in normal times is one reason for its adoption as the world's standard for future installations.

Automatic Electric Company

Factory and General Offices: CHICAGO, ILLINOIS

BRANCH OFFICES IN ALL PRINCIPAL CITIES

Associated Companies

INTERNATIONAL TELEPHONE SALES AND ENGINEERING CORPORATION . . . . . *New York*

INTERNATIONAL AUTOMATIC TELEPHONE COMPANY, LTD. . . . . *London*

AUTOMATIC TELEPHONE MFG. CO., LTD. . *Liverpool*

COMPAGNIE FRANCAISE POUR L'EXPLOITATION DES PROCEDES THOMSON-HOUSTON . . . . . *Paris*

AUTOMATIC TELEPHONES, LTD. . . . . *Sydney*

No. 105
Speaker Complete

Burns
LOUD SPEAKER

For use with phonograph or
Complete with Loud Speaker Horn

Operate on any receiving set having one or more steps of amplification

The Burns Loud Speaker has been designed for broadcast reception. Music and voice are reproduced in their true tone without distortion or harshness and free from disturbing resonance. No experience is required to operate the Burns Loud Speaker. Simply attach in same manner as the head phones. No battery is required. Convenient tone regulator on the back of case permits easy adjustment of tone and volume.

Complete Speaker

No. 105 set consists of a flare horn of proper proportions and neat size mounted on base which holds the speaker unit in position for easy adjustment. The horn is non-vibrating material producing a purity and mellowness of tone impossible to secure from horns of other materials. The voice with all its fine shadings, the various musical instruments with their wide range of pitch will be reproduced with trueness and volume.

Speaker Unit

Note Convenient
Tone Adjuster

The No. 100 Burns Unit can be attached to any phonograph having a tone arm of same dimensions as the Victrola and is easily adapted to other makes. The excellent acoustic qualities of the sound chamber of the phonograph are utilized. This combination make a very neat arrangement for home use.

No. 100
Loud Speaker Unit

No. 100 Burns Speaker Unit, with Victor attachment and Cord $10.00
No. 105 Burns Speaker, complete with horn and base 20.00

Manufacturers of high grade telephones for over 30 years
Full line of switchboards, terminals, and instruments

American Electric Company

State and 64th Streets **Chicago, U. S. A.**

TELEPHONE ENGINEER, January, 1924. Volume 28, No. 1. Published monthly by TELEPHONE ENGINEER. Publication office, 28 E. Jackson Blvd., Chicago, Ill. Subscription price $2 a year in the U. S. Entered as second-class matter June 6, 1922, at the Post Office at Chicago, Ill., under act of March 3, 1879.

GENERAL OFFICES:
28 E. JACKSON BLVD.
CHICAGO, ILL.
Tel. Harrison 4000

TELEPHONE ENGINEER

EASTERN OFFICES:
56 W. 45TH ST.
NEW YORK
Tel. Vanderbilt 3695

VOLUME 28 JANUARY, 1924 Number 1

INDEPENDENT GENERAL STAFF A FACT

When the suggestion was made for the first time in the editorial columns of Telephone Engineer only a few months ago, that a general staff organization was needed in the Independent telephone field, it was little expected that the idea would be taken up immediately and that the organization of such a staff would be well under way before the new year. The proposal met with favor at once as was evidenced by numerous letters received at this office and by discussions among telephone men elsewhere. The officers of the United States Independent Telephone Association immediately recognized that the suggestion was a timely one and began a study of the possibilities.

In his annual report at the October convention, President MacKinnon outlined several steps in the direction of forming such an advisory staff and his recommendations were given sanction at the recent meeting of the executive committee of the board of directors. Presidents and general managers, accountants and auditors and engineering and plant executives of Class A companies will be organized into sectional groups for study of their particular problems. A full time assistant on accounting and financial matters will be added to the general office force of the association and the association will be represented on the American Engineering Standards Committee and on a joint committee with the American Telephone and Telegraph Company and the National Electric Light Association on inductive interference.

Mr. J. C. Paxton, who becomes assistant to the president of the association in financial matters, is a man of experience in operating as well as accounting and financial matters and should be of very great service to association members in these problems. The selection of Mr. A. L. Staderman as representative on the American Engineering Standards Committee will meet with approval in the entire field in which Mr. Staderman is known as a thoroughly competent engineer and operating executive.

The addition of a full time man to the association staff is evidence that the executive committee does not intend to depend solely upon the work of men who are also engaged in work with the operating companies. Experience has shown that the time of a majority of these men is so taken up with the problems of their own companies that they have little left for detail work on association committees. The ultimate organization to function properly will have to be made up of men at association headquarters who spend their entire time on the work under the advice and direction of a committee from the operating field.

That such a staff should spring into being instantaneously cannot be expected. It will come only as a development extending, perhaps, over years. The present plan provides the beginning of such a staff which will grow as its usefulness is demonstrated. It is a real step in advance for the telephone industry; not for the Independents alone, but for the whole industry.

STATISTICS OF THE INDUSTRY

Some interesting figures appear in the preliminary report of the U. S. Department of Commerce, relating to the operation of telephones in 1922. While the wire mileage increased 29.3 per cent and the number of telephones increased 22.4 per cent in the five-year period from 1917 to 1922, there was an actual decrease in the number of public exchanges of 9.1 per cent. While the greater part of this decrease may be accounted for through the elimination of duplication by consolidation in competitive areas, yet it probably means, also, that a considerable number of smaller, uneconomical exchanges have been closed and the service given from larger centers.

The general increased cost of construction is indicated by an increase of plant and equipment value of 47.8 per cent during the same five-year period, as compared with the figures given above for station and wire mileage gain. This indicates an increase in plant value of nearly $300 for each station gained during the period. Salaries and wages have increased to more than double, during the period, while revenue increased only 75.8 per cent. Salaries and wages now absorb 52 per cent of the gross revenue of the telephone companies of the country. These figures indicate impressively the narrowing margin upon which telephone companies have been operating during the past five years. Many of the facts are of interest as general news and telephone managers would do well to see that they are placed before the people of their communities.

THE CITY GROWTH PROBLEM

The observant traveler whether he travels by rail or by automobile cannot help but notice a tendency in the growth of cities toward the covering of larger areas. New subdivisions spring up at the outskirts and are soon covered with houses. Along each of the main highways sometimes for several miles, the land has been cut up into building lots and scattered dwellings are being erected. This tendency has been noted not only in the case of the large or rapidly growing center but also in the smaller cities and those of slower growth.

There are many reasons for this growth among which may be counted high city rents, desire to own a home, space for children to play, the chance to have a vegetable and flower garden, and many others. Hard surface roads and the cheap automobile have made it possible for many families to move away from the more congested residence districts to the outlying areas.

This tendency for cities to spread out brings with it a number of problems for the public utilities, and particularly to the telephone company. Temporary substitutes for the other utilities are available but there is no substitute for the telephone. The people who live in these areas want telephone service and it is a problem to supply it. They are usually located at a distance from the nearest exchange and the cost of reaching them is high. The ultimate development of the area is uncertain and the present development is so scattered that economical plant cannot be built. If cable for ultimate development is installed a considerable part of it will be idle perhaps, for years. If open wire or twisted pair is used, uneconomical plant conditions result.

It will probably be years before plant installed in any of these areas will pay a return on the investment and in some of them it never will pay. If the area is beyond city limits, a zone system or a mileage charge may be applied which will cover part of the additional cost, but if the subdivision is within the city or primary rate area this cannot be done. The cost must be absorbed in the rates for the entire city and if it comes to the point where the entire area does not earn a fair return the only remedy is a general increase in rates. In any case, this tendency in growth should not be overlooked in making estimates for additional plant and of the cost of service in future years.

URGE REPEAL OF MESSAGE TAX

Although President Coolidge has recommended the repeal of the telephone message tax and it is generally understood that this action is likely to be taken, no telephone company should overlook the opportunity to call to the attention of the representatives in congress from its district and the senators from its state, the necessity of the repeal of this section of federal tax laws. This tax is utterly unscientific and has no reasonable excuse for being continued now that the emergency which caused its adoption has passed.

TELEPHONE ENGINEER

Vol. 28 January
No. 1 1924

Entered as second-class matter. June 6, 1922, at the post office at Chicago, Ill., under the act of March 3, 1879.

General Business and Editorial Offices, 28 E. Jackson Blvd., Chicago, U. S. A. Telephone: Harrison 4000.
W. H. Graffis.....Gen. Mgr.
R. V. Achatz.....Technical Editor
Chas. W. McKay.....Associate Editor
Herbert Graffis.....Bus. Mgr.
Jos. M. Graffis.....Advertising Mgr.
G. W. Sutton.....Eastern Mgr.
56 W. 45th Street, New York
Tel. Vanderbilt 3695

SUBSCRIPTIONS
The subscription price of TELEPHONE ENGINEER is $2 a year in the United States, Cuba and Mexico; in Canada it is $3; in all other countries $4. Single copies, U. S. A., 20 cents.

ADVERTISING
TELEPHONE ENGINEER is issued the 15th of each month. Copy can be accepted as late as the 8th of the month preceding date of publication. Where proof must be seen, allow ample time for transmission in the mails. Display Advertising—Rates on application. Classified Advertising—"Wants," "For Sales," etc.—$3 an inch, or 6 cents a word per insertion.

BRINGING THE HIDDEN PLANT TO LIGHT

In a certain community of 28,000 inhabitants there are nearly 7,000 telephones. The telephone company has an actual investment of well toward a million dollars. More than 100 people are on its pay roll. Over twenty miles of trench have been opened in streets and alleys to lay its conduits. Altogether it is one of the largest institutions in the community. Very few people in the community have any conception of the size of the telephone plant that serves them. Too much of it is hidden and the remainder is so scattered that it is difficult to get a picture of its real size. This is one of the difficulties of the business. We have not told the public that there is anything to a telephone plant beyond an instrument and a voice that says "number, please." A considerable portion of our publicity efforts should be directed toward educating the public as to the real size and importance of the telephone system that serves it.

ZONE RATES FOR RURAL LINES

Telephone men in rural communities will watch with interest the results of the experimental order of the Missouri Commission authorizing the Columbia Telephone Company to charge for rural service in accordance with zone rates. The rates range from $1.50 inside the 3½-mile zone to $2.25 outside the 9½-mile zone. It is common knowledge that service is furnished at a loss on long farmer lines and the zone system would seem to offer a means of dividing the cost somewhat more equitably.

START THE JOB NOW

"A job well planned is half finished" is a maxim worth remembering. Applying it to construction plans for the coming season means that much can be done during the winter months before material is delivered to the job and actual work started.

LINE AND DESK

BUILDING HAZARDS

Preventing accidents in buildings should be a comparatively easy matter, as in all of our company-owned buildings proper working conditions have been provided. However, bearing in mind that "Accidents do not happen—they are caused," brings out the fact that proper care is not exercised while performing our various tasks, consequently someone causes an injury to himself or others.

I am reasonably sure that there are no hazards in our buildings, but I am very sure that if we are alive to our surroundings, at all times alert, and have the proper thoughts of safety for ourselves and others constantly on our minds, the accidents we are having will and can be materially reduced.

To my mind the proper condition of our shoes has much to do with accident prevention. Heels that are run down and soles that are badly worn and loose, cause tripping, stumbling and falling accidents, and are in a receptive condition for nails, splinters, etc.

Mops and pails parked in halls and on stairways are serious offenses. The result is obvious.

Rushing around corners and through doorways, especially through swinging doors, should be emphatically banned.

Desk and filing cabinet drawers thoughtlessly left open have caused more than one to bark his shins unnecessarily, as these same drawers could readily have been closed when finished.

It is impossible to prevent time from taking its toll on office furniture. The best of desks and chairs have become worn around the edges and the first report that is generally turned in is an accident report when someone gets a splinter in his hand; whereas, a little thought on some one's part and a small piece of sandpaper in the janitor's hand would have prevented the accident.

Refuse thrown in waste baskets cannot be watched too carefully; broken glass, pieces of tin cans and similar sharp-edged articles can be likened only to rattlesnakes and are about as safe to approach unguardedly.

A thorough inspection should be made of the lighting arrangement in all our buildings, particularly on stairways and corridors, and those in charge of the buildings should see to it that the electric bulbs are always in first-class condition.

Care should be taken in preventing persons from dropping matches on stairways and floors, for there is nothing that will cause a person to skid more easily.

Janitors should be instructed to see that no rubbish accumulates on company property. Spontaneous combustion has been known to be the cause of very serious accidents.

Fire escapes and exits leading to them should be accessible and well lighted and all persons working in a building should familiarize themselves with the nearest fire exit and the quickest and easiest way of reaching it.

Too much care cannot be expended on elevators. In some buildings it is a habit to overtax the elevator rather than to make an extra trip. All elevators have a limited capacity, either in number of persons or pounds. It is safer to make the other fellow wait for the trip than to jeopardize the lives of an elevator full of people. Make sure that the elevator is stopped on a level with the floor before receiving or discharging passengers. The phrases, "Step up and step down" will be done away with. Inside and outside doors should always be closed when the elevator is in motion, even though it is only a one-floor trip that is being made.

Now that we have come down in the elevator, we will glance at the sidewalk which should always be kept clear, especially during the winter months with their snow, ice and slush.

It is thoughtlessness, after all, that is the contributing cause of most of our accidents, so prevent accidents by being thoughtful, then careful.

Prepare yourself mentally for your job, and go out to work as worthy members of our organization who can be depended upon to work under the slogan of safety first.—E. R. Noke in Telephone Topics.

"THANK YOU" MADAM. WE ARE TESTING THE LINE"

In our office the switchboard is located on an upper floor, with the apparatus room on the floor below. A three-inch brass pipe serves as a chute for dropping trouble tickets, etc., from the operating room to the terminal room. When a ticket is to be sent back to the operating room, it is fastened on a clip, which is tied to a cord hanging down through the tube. Tapping on the tube attracts the attention of the supervisor at the switchboard, and she pulls up the cord to get the ticket.

At one time a new boy was added to the force to do odd jobs around the office by helping out wherever needed. He was particularly interested in the test desk and spent much of his spare time there. Often as he was near the test desk he would hear the tester say to a subscriber, "Thank you, madam. We are just testing the line."

One day, after hearing several times this standard phrase at the test desk, the new boy was observed to go over to the ticket chute and tap it. When the supervisor came to the operating room end of the tube he called, "Pull up the cord." She pulled up the cord, only to find nothing in the clip. He then called, "Now let it down again."

After the supervisor had let down the cord wonderingly, he shouted up the tube:

"Thank you, madam. We are just testing the line."

MANHOLE STORM PROTECTION

Many manholes are, no doubt, located in low places or near gutters of streets and are in danger of being flooded, while working on cables during storms.

In some places concrete or clay is used to make a flood wall around the hole while men are working on cables during wet weather.

Our cable-man took a large galvanized iron tub, removed the bottom, and had a piece cut into the side to make the tub almost as large as the crown of the manhole. There is a flange or lid rest about one inch below the top of the crown, so the tub was made just large enough to rest on the flange, leaving about three-fourths of an inch space for packing. Oakum or some other suitable packing is used to pack the small space between the tub and inside of crown. Clay mud is then packed over and around the oakum for a distance of about 4 inches up the side of the tub. This makes a watertight flood wall.

Some time ago a hard storm came

up suddenly while we were splicing an underground cable and we were able to keep the hole perfectly dry. The top of the tub is about 8 inches above the crown of the manhole, the water was almost to the top of the tub.

A hinged window frame, somewhat larger than the tub, is placed over the hole. The glass lets the light in and keeps the rain out, so we are generally all set for any kind of weather. The frame sets in the form of a hip roof. —Contributed by C. W. Kugelman.

Copper Clad Steel Co. Issues New Data Sheet

The Copper Clad Steel Co. recently has sent out an attractive binder with a complete set of Engineering Data Sheets, describing the Copperweld process and the applications of Aristos Copperweld wire. The Copperweld engineers have gone to a considerable amount of trouble to collect data that will be of value to the engineers of wire-using companies and the manual should be a welcome addition to their libraries.

Among the sections that will interest telephone men are those on ground rods; guy, messenger and span wire; telephone line wires and twisted pair. For comparison purposes, the strengths, weights and transmission equivalents of other types of wire than copper clad are given so that the data sheets really form a complete source of information on wires of all types. In addition to the data presented, the sheets present suggestions for construction details.

Copies of the data sheets together with the binder may be obtained by application to the Copper Clad Steel Co., at its main office, Braddock, Pa., or to any of its branch offices, at 30 Church St., New York; 129 So. Jefferson St., Chicago, Ill.; 403 Rialto Bldg., San Francisco, Calif.

Ohio's L.D. Rates Raised

Increases in long distance telephone charges by Ohio Bell Telephone Co. will become effective Jan. 21, says C. P. Cooper, president of the company. The increases will average about 3 cents a call. The company finds that cost of service has increased about 15 per cent during the last 10 years while rates remained unchanged.

Interstate Improving Idaho

E. R. Hannibal, of Spokane, superintendent of the Interstate Utilities Co., says that the company will start work on a $4,000 improvement at St. Maries, Ida., consisting of additional cables through the main part of town and west to Townsite.

"POLE COLLAR" IS A TIME SAVER AND ACCIDENT PREVENTER

Every telephone company at some time or other has experienced accidents due to poles breaking, or falling over with linemen. In an endeavor to reduce accidents from this cause, a device known as a "pole collar" was originated in the office of Frank M. Zanner, Iowa division construction superintendent of the Northwesern Bell Telephone Company. This device, which was described in a recent issue of The Northwestern Bell magazine, consists of a heavy leather belt which

The N. W. Bell "Pole Collars"

fastens around the pole in somewhat the same manner that a lineman's belt fastens around his body. A buckle and a number of holes in the collar permit its adjustment to any size of pole. Four metal rings are fastened to the belt and a hand line is attached to each ring. The lines are used to guy the pole to adjacent poles, trees, strong fence posts, the construction truck or any other convenient support.

The belt is placed at a place where it will not interfere with the workmen; generally about two-thirds of the way from the ground. Every construction crew in Iowa division is supplied with one of these belts and instructions are issued to use it when pole lines are being dismantled or when for any reason the pole may be suspected of being unsafe. Supervisory officers of the company are quoted as saying that it is not only an excellent device for preventing accidents but is also a time saver because it eliminates all of the makeshift methods of guying unsafe poles that have heretofore been used.

Indiana Telephone Association Make Toll Line Trouble Survey

At the convention of the Indiana Telephone Association, in September, a Committee on Better Toll Line Service was appointed and was directed to make a survey of toll line conditions in the state with a view of improving the quality of toll service and reducing the delays in handling traffic. The committee consisted of F. V. Newman, General Manager of the LaPorte Telephone Co., and Chas. S. Norton, of the Indiana Bell Telephone Co., Indianapolis. The report of the committee has been made to the board of directors and has been approved. Plans are now under way to put the recommendations into operation. The secretary of each district association will be furnished with survey blanks which will be filled out by the companies in the district. The president and secretary of the district association then constitute a committee to study the situation in the district and to recommend improvements. In case any company is found to have faulty conditions which it fails to remedy at the suggestion of the district association officers, the matter will be referred to the president of the state association who will appoint disinterested arbiters, if necessary. If any companies refuse to make improvements recommended in the report of a competent engineer, who may be employed by the state association, in specific cases, machinery is provided for carrying the case before the public service commission.

Class "D" Companies Need Not Report to Interstate Commerce Commission

Class "D" telephone companies are relieved from making reports to the Interstate Commerce Commission by an order of the commission on Dec. 5th, annulling that portion of its order of July 24th which required the filing of copies of reports to state public service commissions. A copy of the order has been mailed to all member companies of the United States Independent Telephone Association. In commenting upon the order, President MacKinnon recommends that all companies relieved of making these reports still continue to keep accounts as prescribed by the previous orders of the Interstate Commerce Commission unless governed by rules of their state commissions. Attention is called to the benefits of the uniform system and to the difficulties in which a company may find itself in rate cases, settlement of disputed claims with the income tax unit, etc., if the system is not followed.

Index to Volume XXVII

JANUARY—DECEMBER, 1923

TELEPHONE ENGINEER

A

Alloys Aid our Industry, 7-28.
A. I. E. E. Telephone and Telegraph Committee Report, 1-34.
Annual Report of Bell Company, 3-18.
Automatic Development, by F. J. Dommerque, 8-22.
Automatic in England, Relay, 1-26.
Automatic in India, 6-46.
Automatic, London Orders, 9-40.
Automatic Exchanges, Small, by F. J. Dommerque and Erwin Gendriess, 10-27.
Automatic Men Still Climbing, 5-29.

B

Bell Company Annual Report, 3-18.
Bell Pioneers Meeting, 11-31.
Book Reviews:
- Electrical Vibration Instruments, by A. E. Kennelly, 10-23.
- Manual of Artificial Respiration, by G. R. G. Fisher, 10-23.
- Printing Telegraph Apparatus, by H. H. Harrison, 5-26.
- Telephone Erection and Maintenance, by H. G. White, 4-48.
- Your Telephone-Voice of Your Business, by Pauline Dunstan Belden, 5-26.

Buried Cable Trouble Study, by Stephen M. Isom, 3-19.
Buried Cable, More About, by C. W. Kugelman, 4-25.

C

Cable Borer, Lead, in California, by H. E. Burke, R. D. Hartman and T. E. Snyder, 4-37.
Cable, More about Buried, by C. W. Kugelman, 4-25.
Cable Maintenance Methods, by M. T. Caster, 5-13.
Cable, The Rhineland, 1-26.
Cable, Trouble Study of, Buried, by S. M. Isom, 3-19.
Chicago, Machine Switching at, 6-25.
Code of Ethics Adopted by U. S. I. T. A., 11-27.
Construction Costs, Cutting, by R. V. Achatz, 3-15.
Conventions:
- Canadian, 12-10.
- National, 11-19.
- State, Arkansas, 2-36.
- State, California, 5-31.
- State, Florida, 4-28.
- State, Georgia, 6-44.
- State, Illinois, 12-20.
- State, Indiana, 10-32.
- State, Iowa, 5-30.
- State, Kansas, 4-27.
- State, Minnesota, 2-26.
- State, Nebraska, 3-38.
- State, New York, 5-30.
- State, North Dakota, 4-27.
- State, Ohio, 3-29.
- State, Pennsylvania, 2-36.
- State, South Dakota, 2-18.
- State, Texas, 4-28.
- State, Vermont, 8-27.
- State, Wisconsin, 4-28.

Co-operation in Education, 4-33.
Co-operative Publicity Pays, by J. E. Bullard, 8-39.
Cord Circuit Requirements, by D. E. Wass, 10-21.
Customer Ownership Facts, 10-48.

D

Derrick, New Pole Raising, by J. N. Kirk, 9-23.
Development Studies, Telephone, 7-24.
Digest of Articles on Telephone, and Allied Subjects:
- Origin of Pupin Invention, by M. Pupin, 3-32.
- Physical Interpretation of Complex Angles, by Aram Boyajian, 3-21.
- Public Address Systems, by I. W. Green and J. P. Maxfield, 5-26.
- Telephone Transmission over Long Distances, by H. S. Osborne, 11-32.
- Telephone Transmission over Long Cable Circuits, by A. B. Clark, 4-48.
- Transatlantic Radio Telephony, by H. D. Arnold and Lloyd Espenschied, 10-23.
- Use of Public Address Systems with Telephone Lines, by W. H. Martin and A. B. Clark, 5-26.
- Wind Shielding of Conductors, by P. J. Howe, 3-21.

E

Editorials, 1-24, 2-24, 3-30, 4-21, 5-24, 6-26, 7-15, 8-15, 9-15, 10-17, 11-15, 12-15.
Education, Illinois Plan for Co-operation in, 4-33.
Employees Share Earnings, 9-31.
Ethics, Code Adopted by U. S. I. T. A., 11-27.
European Long Lines, by Frank Gill, 2-19.
European Wire Systems, by Bruno Shapira, 5-44.
Everyday Telephone Helps, by P. Kerr Higgins, 5-17, 6-15, 7-33, 8-24, 9-27, 10-33, 11-38, 12-32.
Exchanges, Small Automatic, by F. J. Dommerque and Erwin Gendriess, 10-27.
Executives, Training Future, 12-23.
Exhibits at Chicago, 11-34.
Extensions of our Earnings, by R. V. Achatz, 3-37.

F

Farm Telephone Field Still Big, 5-28.
Finance, State Chiefs Discuss, 11-32.
Financing Organization Plan of U. S. I. T. A., 1-15.
Financing, Texas Plan, by Judge S. A. Lindsey, 11-24.
Forecasts, Short Period, by Perry W. Smith and R. E. Shook, 10-29.

H

Heavy Duty Special Truck, A, 4-35.

I

Ice Breaks Poles, When, by G. E. Heck, 2-13.
Independent 4½ Percent Views, 10-41.
Independent Pioneers Gather, 11-26.
Industry Grows into New Homes, 2-21.
Investments, Utility, are Safe, by B. E. Sunny, 7-26.

J

Japan Sends Thanks, 12-27.

L

Line and Desk Department, 4-15, 5-20, 6-23, 7-18, 8-17, 9-19, 10-19, 11-17, 12-28.
London Orders Automatic, 9-40.
Long Lines, European, by Frank Gill, 2-19.
Loudspeaker, Designing the, by John B. Rathbun, 10-37.

M

Machine Switching at Chicago, 6-25.
Machine Switching Systems, by E. B. Craft, H. P. Charlesworth and L. F. Moorehouse, 6-29.
Maintenance Methods, Cable, by M. T. Caster, 5-13.
Missouri Decision, The, 6-50.

N

New York Rates Revised, 2-26.

O

Obituary:
- W. W. Dean, 6-44.
- E. A. Reed, 12-34.

Ontario Telephone Act, The, by Francis Dagger, 1-27.
Opinions and Comments, 1-24, 2-24, 3-30, 4-21, 5-24, 6-26, 7-15, 8-15, 9-15, 10-17, 11-15, 12-15.
Origin of Pupin Invention, by M. Pupin, 3-21.

P

'Phones for All, by Clyde M. Reed, 1-31.
Physical Interpretation of Complex Angles, Digest, 3-21.
Pioneers, Bell Meeting, 11-31.
Pioneers, Independent, Gather, 11-26.
Place for Everything, by O. C. Rynearson, 3-21.
Planning Ahead for Thrift, by H. B. Thayer, 9-35.
Pole Strength, Test Wooden, 12-19.
Pole Treatment Results, 5-24.
Poles, When Ice Breaks, by G. E. Heck, 2-13.
Poles, Strength of Telephone, by J. M. Walshe, 9-17.
Practical Plant Problems, by Charles W. McKay, 1-42, 2-27, 3-31, 4-36, 5-33, 6-20, 8-28, 10-24, 11-33, 12-30.
Protection, Substation, by R. V. Achatz, 11-21.
Public Address Systems, Digest, 5-26.
Public Address Systems with Telephone Lines, Use of, Digest, 5-26.
Publicity Pays, Co-operative, by J. E. Bullard, 8-39.

R

Radio Antenna Tuning Calculation, by R. T. Cloud, 10-42.
Radio Apparatus, Tuning, by R. T. Cloud, 8-33.
Radio Broadcasts, Relaying, by John B. Rathbun, 4-13.
Radio by Telephone in Kansas, 6-48.
Radio Circuits, Reflexed, by John B. Rathbun, 9-21.
Radio Frequency Currents, by R. T. Cloud, 6-21.
Radio Grief in Texas, 5-32.
Radiophone Spans Atlantic, 2-16.
Radio Rebroadcasting Plan, by John B. Rathbun, 7-21.
Radio Regulations, New, 5-32.
Radio Supplement to Wire, by R. T. Cloud, 2-23.
Radio Survey, Up-to-date, by R. V. Achatz, 1-13.
Radio Telephony, Transatlantic, Digest, 10-23.
Railroad Work, Telephone in, by John W. Gorby, 12-22.
Rates, Standardization of Telephone, by C. A. Wright and D. B. Judd, 2-21, 3-21, 4-17.
Relay Automatic in England, 1-26.
Research Work Outlined, 1-33.
Restoring Service, Record in, 8-19.
Rhineland Cable, The, 1-26.

S

Short Period Forecasts, by Perry W. Smith and R. E. Shook, 10-29.
Sleet Knocks out Dixie Lines, by T. Barton Baird, 3-13.
Spring Construction Plans, 4-23.
State Chiefs Discuss Finance, 11-32.
Storage Battery Upkeep, by D. D. Sandefur, 7-23.
Substation Protection, by R. V. Achatz, 11-21.

T

Telephone and Telegraph Committee Report, A. I. E. E., 1-34.
Telephone Data Sheets, by John B. Rathbun, 3-42, 4-40, 5-35, 6-38, 8-31, 9-34, 10-46.
Terminating Overhead Lines, by Frank G. Hyland, 8-20.
Testing with a Simple Outfit, by Fred G. Pyle, 2-33.
Texas Financing Plan, by Judge S. A. Lindsey, 11-24.
Training Future Executives, 12-23.
Transmission over Long Cable Circuits, Telephone, Digest, 4-48.
Transmission over Long Distances, Telephone, Digest, 11-32.
Trouble and the Subscriber, by C. W. Kugelman, 12-17.
Truck, A Heavy Duty, 4-35.
Truck and Telephone Allies, by J. W. Spaulding, 12-35.

V

Valuation in Rate Making, by Charles W. McKay, 1-16, 2-30, 3-33, 4-29, 5-27, 6-42, 7-29, 8-29, 10-39, 11-28, 12-25.

W

Waste in Plant Operation, by R. V. Achatz, 6-13.
"Way Back When," by John M. Walshe, 1-19.
Wind Shielding between Conductors, Digest, 3-21.
Wood Preservation, Ten Years' Record in, 10-52.

AUTHORS' INDEX

A

Achatz, R. V., Cutting Construction Costs, 3-15.
- Extensions out of Earnings, 3-37.
- Substation Protection, 11-21.
- Up-to-date Survey of Radio, 1-13.
- Waste in Plant Operation, 6-13.

B

Baird, T. Barton, Sleet Knocks out Dixie Lines, 3-13.
Bullard, J. E., Co-operative Publicity Pays, 8-39.
Burke, H. E., with R. D. Hartman and T. E. Snyder, Lead Cable Borer in California, 4-37.

C

Caster, M. T., Cable Maintenance Methods, 5-13.
Charlesworth, H. P., with E. B. Craft and L. F. Moorehouse, Machine Switching Systems, 6-29.
Cloud, R. T., Antenna Tuning Calculation, 10-42.
- Radio Frequency Currents, 6-21.
- Radio a Supplement to Wire, 2-23.
- Tuning Radio Apparatus, 8-33.

Craft, E. B., with H. P. Charlesworth and L. F. Moorehouse, Machine Switching Systems, 6-29.

D

Dagger, Francis, The Ontario Telephone Act, 1-27.
Dommerque, F. J., Automatic Development, 8-22.
- with Erwin Gendriess, Small Automatic Exchanges, 10-27.

G

Gendriess, Erwin, with F. J. Dommerque, Small Automatic Exchanges, 10-27.
Gill, Frank, European Long Lines, 2-19.
Gorby, John W., Telephone in Railroad Work, 12-22.

H

Hartman, R. D., with H. E. Burke and T. E. Snyder, Lead Cable Borer in California, 4-37.

Heck, G. E., When Ice Breaks the Poles, 2-13.
Higgins, P. Kerr, Everyday Telephone Helps, 5-17, 6-15, 7-33, 8-24, 9-27, 10-33, 11-38, 12-32.
Hyland, Frank G., Terminating Overhead Lines, 8-20.

I

Isom, Stephen M., Buried Cable Trouble Study, 3-19.

J

Judd, D. B., with C. A. Wright, Standardizing Telephone Rates, 2-21, 3-21, 4-17.

K

Kirk, J. N., New Pole Raising Derrick, 9-23.
Kugelman, C. W., More about Buried Cable, 4-25.
Trouble and the Subscriber, 12-17.

L

Lindsey, Judge S. A., Texas Financing Plan, 11-24.

M

McKay, Charles W., Practical Plant Problems, 1-42, 2-27, 3-21, 4-36, 5-33, 6-20, 8-28, 10-24, 11-33, 12-30.
McKay, Charles W., Valuation in Rate Making, 1-16, 2-30, 3-33, 4-29, 5-27, 6-42, 7-29, 8-29, 10-39, 11-28, 12-25.
Moorehouse, L. F., with H. P. Charlesworth and E. B. Craft, Machine Switching Systems, 6-29.

P

Pyle, Fred C., Testing with a Simple Outfit, 2-33.

R

Rathbun, John B., Designing the Loudspeaker, 10-37.
Radio Rebroadcasting Plan, 7-21.
Reflexed Radio Circuits, 9-21.
Relaying Radio Broadcasts, 4-13.
Telephone Data Sheets, 3-42, 4-40, 5-35, 6-38, 8-31, 9-34, 10-46.
Reed, Clyde M., 'Phones for All, 1-31.
Rynearson, O. C., A Place for Everything, 3-21.

S

Sandefur, D. D., Storage Battery Upkeep, 7-23.
Shapira, Bruno, European Wire Systems, 5-44.
Shook, R. E., and Perry W. Smith, Short Period Forecasts, 10-29.
Snyder, T. E., with H. E. Burke and R. D. Hartman, Lead Cable Borer in California, 4-37.
Spaulding, J. W., Truck and Telephone Allies, 12-35.
Sunny, B. E., Utility Investments are Safe, 7-26.

T

Thayer, H. B., Planning Ahead for Thrift, 9-35.

W

Walshe, John M., "Way Back When," 1-19.
Walshe, John M., Strength of Telephone Poles, 9-17.
Wass, D. E., Cord Circuit Requirements, 10-21.
Wright, Prof. C. A. and D. B. Judd, Standardizing Telephone Rates, 2-21, 3-21, 4-17.

Illinois District Meets

Brisk Sessions at Jacksonville Are Devoted to Practical Problems

Jacksonville, Ill.—Those who attended the district meeting and traffic conference of The Illinois Telephone Association December 12th, were amply repaid. The arrangements for the meeting made by J. H. Dial, General Manager of the Illinois Telephone Co., comprised not only delightful quarters for the two meetings of the conference, but automobile transportation for the ladies in attendance and an excellent luncheon with the directors and members of the Jacksonville Chamber of Commerce and other civic societies at which Mr. Dial presided.

After introducing Mr. Holliday, the dean of independent telephone men in central Illinois, Mr. Dial introduced in succession a number of telephone people in the audience who had been connected with the industry for twenty years or more, and it was found that Mrs. E. J. Huff, of Virginia, had become connected with the telephone industry of the great state of Illinois in the year 1892 and was entitled to the honors in this respect.

Mayor Crabtree of Jacksonville addressed the meeting on the theme of service in the broad sense, stressing cooperation between the public and the utilities, the cultivation of an attitude of service-giving on the part of the utilities, consideration for the utilities in all of their problems.

In the absence of Dr. R. E. Gordon, President of the Illinois Telephone Association, A. R. Patterson, of Streator, Vice President, in a few brief remarks spoke of the Illinois Telephone Association and its objects. Rev. Pontius of Jacksonville addressed the luncheon.

At the sessions of the executives' conference addresses were delivered by A. R. Patterson on the subject of "Public Relations in Your Own Organization," the address being illustrated by stereopticon. A resume of the difficulties and remedies of financing plant extensions for small telephone companies was given by Jay G. Mitchell, Secretary-Treasurer of the Illinois Telephone Association. The subject of a state police for Illinois and wayside telephone service was discussed by E. D. Glandon of Pittsfield, N. E. Mann of Bushnell, E. D. Boynton of Springfield, F. W. Kelly of Springfield, as well as a number of others. The subject is one of lively interest to the telephone utilities.

At the afternoon session a demonstration of line wire working, including subscribers' drops, was given by E. R. Millard of Springfield. Mr. Millard's demonstration was of the most absorbing interest to those present and brought forth a lively and interesting discussion of various methods in comparison with the standard methods of the Illinois Bell Telephone Co. which Mr. Millard illustrated. The feature of actual working demonstrations of cable splicing and line wire work at district meetings was inaugurated by the Illinois Telephone Association last year, and has been found to be of constructive value in connection with the work of the Association, especially with its smaller member companies. After the conclusion of Mr. Millard's line wire demonstration W. S. Ferguson addressed the meeting on the subject of liability insurance.

In the traffic conference, which was conducted under the supervision of Miss Pearl Thompson, Traveling Chief Operator of the Illinois Telephone Association, operators from sixteen different communities were present, as well as young ladies representing the electric light and power companies operating in central Illinois. The discussions in the operators' meeting were very timely and interesting, and were illustrated largely by stereopticon. Not only is the service of this Department being rendered to member companies through the medium of the district traffic conferences but expert traffic instruction is being given upon request to member companies of the Association in their own organizations. The results are already being felt wherever this service has been given, not only in a great improvement in the operating room spirit but in a distinct betterment of service received by the telephone-using public.

Department of Commerce Presents 1922 Census of Telephones

Washington, D. C.—The Department of Commerce presents preliminary census figures relating to the operations of telephone companies in the United States during 1922, as compared with the year 1917.

The figures show an increase of 29.3 per cent in miles of wire, accompanied by an increase of 22.4 in number of telephones. The estimated number of messages or talks increased 2,893,036,404, or 13.2 per cent.

The number of employees increased 18.8 per cent, and the amount paid for salaries and wages more than doubled between 1917 and 1922. The operating and nonoperating revenue increased from $389,499,631 in 1917 to $684,904,736 in 1922, or 75.8 per cent, and the value of plant and equipment increased nearly 50 per cent.

The figures are shown in the following table:

	1922	1917	Per cent of increase or decrease(-)
Number of systems or lines	57,248	53,234	7.5
Miles of wire	37,265,528	28,827,188	29.3
Number of telephones	14,346,701	11,716,520	22.4
Estimated number of messages or talks	24,738,758,739	21,845,722,335	13.2
Number of public exchanges	19,254	21,175	-9.1
Number of employees	312,127	262,629	18.8
Male	104,513	91,510	14.2
Female	207,614	171,119	21.3
Salaries and wages paid	$353,263,801	$175,670,449	101.1
Revenue, operating and nonoperating[1]	$684,904,736	$389,499,631	75.8
Value of plant and equipment	$2,205,121,610	$1,492,329,015	47.8

[1]Including assessments of mutual companies

The Bell Telephone Co. of Pennsylvania and associated companies, the latter serving Delaware and southern New Jersey, have in service 948,000 telephones connected by a network of a little more than 8,071,000 miles of wire

The Year 1923 in Review

A Brief Survey of Accomplishment in the Telephone Field During 1923. Steady Progress Shown in All Departments, and an Increased Stability of the Industry Noted

BY THE EDITOR

The year 1923 will be remembered in the telephone industry, not as a year of any one outstanding achievement, but rather as a year of development along constructive lines and of general improvement in the industry. The close of the year finds the industry in a better condition, financially, and its relations with the public and with its employees greatly improved over 1922; also, with a substantial number of technical and operating improvements. Elimination of competition has progressed and service has been unified to the extent that the telephone network of the country now is practically a single system, as far as interchange of traffic is concerned.

The persistent growth of the business during the past year, continuing that of other years, has been a matter of wonder to those not closely in touch with it. The saturation point still seems to be as far off as it seemed years ago. This condition has led to the announcement of immense outlays for new construction during the past year, and these may be expected to continue for some time. The Bell system now is working on a five-year budget plan and the amount of new construction contemplated in the next five years involves sums of money that are fairly staggering. While in the greater number of cities, plants have been so constructed that a normal amount of spare facilities is available for new installations, in many places the growth has absorbed the facilities as soon as they became available, and relief is not yet in sight. Even where facilities are now available, the plant will soon become congested and additions will be required.

In the rural districts and in small towns the growth has not been so rapid, due, principally, to the difficult financial conditions that have faced the farmer in the past two or three years. That there is ample room for expansion of the farm telephone is shown by the report of the U. S. Department of Agriculture, which shows that in Iowa, the best developed state as far as farm telephones are concerned, nearly one-sixth of the farms still are without telephone service. In other states the development is much smaller, only three states, Illinois, Kansas and Nebraska, having telephones on more than two-thirds of the farms.

Revenue and Rate Situation

The matter of adequate rates and revenues was the subject of much consideration during the year. Study of the situation by the United States Independent Telephone Association showed that the Bell companies in 1922 earned 5.6 percent on the invested capital, while Independent Class A companies earned 5.2 percent and Class B companies earned 5.4 percent. Rate increases were granted to a number of companies during the year, but in some cases the increases were not all that were asked by the companies. In several states, decreases were ordered by public service commissions, notably in Michigan and New York and in the City of Chicago. In all of these cases, the reductions were contested and the matters are now before the courts.

Court decisions during the year have tended to clarify the rate-making situation. Particularly important in this respect was the decision of the U. S. Supreme Court in the Southwestern Bell Case, involving rates in Missouri. In this case, the court held that reproduction cost must be given consideration, the 4½ percent contract with the American Telephone and Telegraph Co. was upheld and attention was called to the fact that the commission could not assume a position of interfering with the management of the property. In a case involving rates in several exchanges of the same company in Kansas, the public service commission was overruled by the State Supreme Court.

On account of the illness of Charles W. McKay, associate editor of TELEPHONE ENGINEER, who is suffering from pleurisy and bronchitis, the January installments of Mr. McKay's serial articles will be omitted.

"Valuation in Rate Making" and "Practical Plant Problems," the two McKay features that have won such high approval from TELEPHONE ENGINEER'S readers, will again appear in the February issue.

Interstate Commerce Commission Regulations

The Interstate Commerce Commission continued its study of depreciation during the year and a number of hearings were held at which voluminous testimony was introduced by both Bell and Independent interests. No order has been issued by the commission in the matter and further study undoubtedly will be given to it.

A new classification of telephone companies was made by the Interstate Commerce Commission during the year, the lower limit of annual revenue for Class B companies being placed at $100,000. Class C companies, which now include all those having revenue below $100,000 annually, are released from all accounting and report requirements by the Commission.

Association Activities

The year has been one of increasing activities on the part of the National and State Associations. Several important projects have been undertaken by the national Independent association along the line of employees' welfare work, financing and substation protection. Probably the most important feature of the work of the association was the taking of the first steps toward the formation of a general headquarters staff for the Independent side of the industry, following the lines of a suggestion made in Telephone Engineer late in the summer. The executive committee of the association approved the plan at its meeting in December and J. C. Paxton was appointed assistant to the president to handle accounting and financing problems. A. L. Staderman was appointed representative of the association on the American Engineering Standards Committee.

The state associations have been active during the past year in a number of states and much benefit has come from their work. Several of them have been fostering the district meeting plan and in this way have brought the work of the association directly to the companies. Operators' and plant schools have been features of these dis-

trict meetings and they have been attended by many telephone men and women who, ordinarily, are not able to attend state conventions.

Financing During the Year

The year was not marked by the large scale financing of the previous year, when many issues of preferred stocks were placed on the market by Bell subsidiaries. The year was notable, however, for the increasing distribution of telephone securities. The customer ownership idea has gained a strong footing, not only among the Bell companies but also among many of the Independents. The Keystone Company of Philadelphia was engaged at the close of the year in marketing an issue of preferred stock among its subscribers. Stock ownership among employees also is on the increase.

Much study was given the matter of financing the smaller companies during 1923, a notable contribution being the development of the so-called "Texas Plan" of making loans which are paid back in installments. This plan already is in operation in Texas and, likely, will be placed in operation in other states during the coming year.

Elimination of Competition

Two of the large Independent companies passed out of existence during the year. The Kinloch, of St. Louis, and the Citizens, of Grand Rapids, were absorbed by the Bell companies in their respective territories. Some smaller properties also were absorbed by the Bell, but in other locations Bell plants were taken over by Independents, so that the number of stations acquired by the Bell, outside of the two larger companies named, practically was balanced by those transferred to Independents. A contract for division of territory was made between the Bell Telephone Co., of Pennsylvania, and the Consolidated Telephone Co. of Hazleton, Pa. In general, the operation of the plan set up in the "Hall Memorandum" has been found to be satisfactory to both Independent and Bell interests.

Employees Relations

The relations between telephone companies and their employees have continued to be good. The only exception to this was the unsuccessful strike of operators in New England. Telephone companies have maintained rates of pay and have been able to bring the efficiency of the operating and plant employees back to even higher than pre-war standards. An attempt to work out an employees' benefit plan on a national scale by the U. S. Independent Association has not yet been successful, but the investigation is being continued.

Technical Advances

Advancement in technical matters continued along many lines. No radical changes in practice were developed but many improvements were made, particularly along the lines of long distance telephony. The extension of the long distance cable plant brought many problems that have been worked out successfully and it is only a matter of a short time now until all of the important centers between Chicago and Boston will be connected by long distance cables. Many extensions of carrier telephone and telegraph circuits on long distance wires were made.

In local plants, the use of cables containing 1200 pairs of wires was extended and resulted in some marked economies in plant construction in congested districts. The installation of machine switching offices of the panel type in large cities was continued and a number of offices were cut into service. Several offices in New York City and two units in Chicago were placed in service during the year. There seemed, however, to be a noticeable slackening up of announcements of future offices of this type to be installed. Equipment costs for this type seem to be at a place that can be justified only in the largest cities. In cities of moderate size installations of the step-by-step or Strowger type continued and several automanual installations were made. In still smaller exchanges, the manual boards of high efficiency cord circuits with automatic features grew in favor and many new switchboards of this type were placed in service. Development in equipment was largest in the direction of refinements of circuit and apparatus design.

Some Traffic Notes

In the traffic department, operating methods were given extensive study. A committee of the Independent association continues working over the long distance operating rules, in order to bring about uniformity, and to incorporate recent improvements. Probably the greatest advance during the year were the introduction of "overlap ringing" which has resulted in a considerable reduction of the operating time on toll circuits and also has improved the service from the subscriber's standpoint. In Iowa and Illinois, traveling chief operators have continued their good work among the operators at the exchanges in those states.

Radio Telephony

The most spectacular feat in radio telephony during the year was the transmission of voice to England. During tests extending over two hours in January, President H. B. Thayer, of the A. T. & T. Co., and other officials were heard continuously by observers in London. The radio link in the Los Angeles-Catalina Island circuit was replaced by submarine cables during the year, thus eliminating the only commercial radio telephone message circuit in operation up to this time. It is becoming increasingly apparent that, only in exceptional cases, such as across long stretches of ocean or to ships or other moving objects, can the radio telephone become a practicable means of transmission of messages by voice.

Carrier current systems have been applied to power lines in greater numbers and are reported to be operating satisfactorily. A re-distribution of broadcasting wave lengths has eliminated much interference and many of the smaller stations have discontinued broadcasting service.

New European Era

Telephone Ushering in an Epoch of International Significance

It may be possible soon to talk from Stockholm to Rome with the same facility with which an American talks from New York to St. Louis. An era of long distance communication in Europe is just beginning, according to C. H. Minor, European Commercial Manager of the International Western Electric Co., who has just arrived in New York from the company's offices in London. An order has been placed by the French government for a new cable from Paris to Strassbourg, which is, in itself, one of the greatest telephone projects to be undertaken in Western Europe. This cable, and the new system which will be built up around it, will give France interurban telephone communication with high standards of transmission efficiency, and France, from its geographical position, is bound to play an important part in European international communication.

Interurban telephone developments in Italy, Switzerland and Sweden have also an international significance, for they tend to make telephone communication in Europe much easier of accomplishment.

Long distance communication is likely to be an important factor in Europe, leading to closer commercial and political relationships. Just what the ability to talk freely from city to city will mean to Western European countries can only be surmised, but its importance in America suggests that the influence upon Europe will be far-reaching.

"Engineers of the governments in Europe are beginning to hold meetings to consider ways and means of establishing long distance lines with satisfactory transmission standards," says Mr. Minor. "Much progress has been made in the last year."

A Clinic on the Telephone

Queries Regarding Induction Coils Are Answered — Details of Design and Performance Given — Receiver Construction, Together with Some Diaphragm Details — The Generator's Work

By P. Kerr Higgins

Among the many questions asked concerning the preceding articles, the greatest number seems to have been in regard to induction coils. The following further information is given in response to these questions: A telephone induction coil is the transformer of the telephone instrument. By its use, although the dry battery furnishes direct current to the transmitter, an alternating current is delivered to the line circuit. Normally an undulating current flows in the primary circuit and produces an alternating current in the secondary circuit. The primary and secondary circuits in an induction coil are separate and distinct from each other, the only connecting link being by means of induction. The low potential of the undulations of current in the primary circuit is transformed to a higher line pressure so that resistances are more easily overcome. As the line resistance increases, it would appear as if the pressure of the secondary should rise in proportion to take care of the increased resistance. However, the induction coil is not a constant current transformer and has no regulation provided, the secondary voltage being uniform regardless of the external load.

The induction coil for subscribers' work is usually one with low resistance and the ratio of transformation is about nine to one. In the local battery set, transmitter resistance sometimes runs as high as sixty ohms. The dry cells have a resistance of one-half ohm, while the primary has an apparent resistance of about the same amount. The drop of potential which acts on the line is that across the primary winding of one-half ohm. About one-sixtieth of the three volts from the dry cells thus appears at the primary terminals, the rest of the voltage being consumed at the transmitter and its connections. With a low resistance transmitter the voltage across the coil is increased proportionately. It is therefore a question of having the resistance of the transmitter suitable for long distance transmission and of getting a primary circuit with energy enough to supply the demands of the line.

No definite law governing the construction of induction coils has been agreed upon, as it has been found impossible to construct such a coil so that it would automatically adjust itself to all the variations of a telephone circuit, such as the capacity and resistance of the line, other instruments on the line, variation in transmitters, and variation in battery supply. Each manufacturer therefore has sought to construct an induction coil which will be best suited to co-ordinate with his apparatus. This is a good argument for the standardization of subsets. If a high wound induction coil is placed at one end of the line and a low wound coil at the other end, the party having the low wound coil would hear best. Hence, in testing induction coils it is always best to use coils exactly alike. The following table is the result of experiments on a number of types of induction coils conducted by one of the large telephone equipment manufacturers and is very convenient for reference.

No.	Number of turns on primary.	Size of wire.	Resistance.	Number of turns on secondary.	Size of wire.	Resistance.	Diameter of core.	Length of core.	Ratio of transformation.	Percentage of volume and clearness on 5-mile line.	Percentage of volume and clearness on 100-mile line.
1	111	22	.39	5140	38	157			46	67	124
2	14	22	.14	2246	38	870				57	68
3	168	22	.62	2184	38	885				91	89
4	80	22	.27	3413	38	376				47	
5	44	23	.09	2688	38	270				56	
6	150	22	.56	4254	38	853					
7	124	22	.24	1240	38	43					
8	208	22	.54	1400	30	35					
9	400	26	2.	1506	28	33				101	
10	228	22	.52	990	26	26				95	
11	400	26	2.1	1241	28	16				102	
12	200	22	.48	5500	36	480				88	
13	252	18	.99	420	22	2				92	
14	400	26	2.1	1700	28	21				107	
15	113	22	.40	554	28	5	1.75			64	
16	371	26	3.5	5503	33	74				101	
17	170	22	.56	2600	26	26				88	
18	272	20	.88	3139	32	84				100	
19	275	18	.88	3034	30	84				100	
20	275	18	.88	3010	30	317				98	

Fig. 1

The difference between substation induction coils and those used in operators' sets, is that the latter, being in a bridge connection to reduce side tone, must have a fairly high impedance, while the subscriber's coil, being in series with the talking circuit, has to have a lower impedance. To kill side tones in local battery sets, a three ohm coil placed in shunt about the primary may be used. Such a device, however, cuts down the efficiency of transmission. There seems to be no fixed relation between the primary and secondary resistance of coils made by different manufacturers. The important matter is the ratio of the number of turns used and their relation to each other and the iron core. The resistance of the coil is the result of winding a required number of turns of wire in a given space. Winding the secondary to abnormal resistance, say in excess of two hundred ohms, makes its inductance so great that the major part of the voltage is wasted in overcoming impedance within the coil itself.

It is important that insofar as possible the induction coil designed by the manufacturer for use in his own circuit should be used in preference to that of another make. This is because of the relations existing between the pressure—resistance curve of the transmitter and the average resistance of the primary circuit while talking, which affects clearness rather than loudness. A loud transmitter will have a wide range through which it can vary its resistance. The following is a description of what is considered by many to be well proportioned induction coil. Core wires, No. 24 B. & S. gauge, coil bobbin four inches long, core 9/16 in. in diameter, primary 200 turns of No. 20 silk covered wire two layers deep, secondary 1,400 double turns two wires side by side No. 34 gauge insulated wire. Resistance of primary 38 ohms, resistance of secondary 75 ohms.

In many types of present-day circuits a tie is used between the primary and secondary circuit, as shown in diagram, Fig. 2.

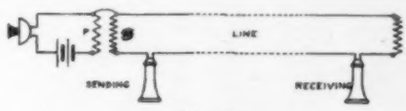


Fig. 2

This does not affect or destroy the induction betwen the primary and secondary, there being no return path for the current.

With these facts in mind, the action of the induction coil may be reviewed briefly. When the transmitter is normal, that is when no vibration or variation is taking place, the primary current flows in a steady manner through the primary winding and magnetizes the iron core to a certain extent. When the condition of the transmitter changes as when it is in use, the variation of resistance taking place in the

transmitter causes variations to take place in the primary current. This rise and fall of the current strength causes the magnetism of the core to vary proportionately and since the secondary winding is in the same magnetic field the variations of the primary produce an alternating electromotive force in the secondary winding, which forces the current over the line to the other telephone. The voltage increase is proportional to the ratio to the number of turns in primary and secondary. The voltage in the secondary circuit of the telephone can be measured only with the most sensitve alternating current instruments such as the thermogalvanometer.

A Difficult Case of Induction Coil Trouble

One of the most difficult cases of trouble for the trouble man to locate in a common battery system is that caused by a cross between the primary and secondary of the induction coil. Usually the first induction of this trouble is that the subscriber cannot hear, while the operator seems to hear all right. Upon going to the substation, the experienced trouble man will note that while he may be able to hear the operator it sounds like she were "down in a well." If on a party line having several telephones all of the telephones may be more or less affected and the trouble can usually be located at the one showing most decidedly this peculiar sound. The best method to test induction coils for a cross in the windings is by means of a direct reading volt meter with a battery in series. By means of this portable instrument, all the troubles of the induction coil can be promptly located. If such an instrument is not available, then with a little experience and practice, a sensitive receiver might be used in its place, but the volt meter method is preferable.

Some Additional Information Concerning the Receiver

Several people have also asked for further information regarding the telephone receiver and other parts of the telephone. It is evident that some of them, at least, have overlooked the telephone tables compiled and published in TELEPHONE ENGINEER by J. B. Rathbun.* As these tables will answer many of the questions asked, it will not be necessary to cover some of the points. However, the following further information may help answer some of the questions which have not been covered heretofore.

Why a Telephone Sings When Receiver Is Held Against Transmitter

In practice many trouble men test the tone quality of a transmitter by placing the ear piece of the receiver against the mouthpiece of the transmitter and by moving it slightly from side to side set up vibrations in the transmitter and receiver so that a distinct whistle is heard. The explanation offered for this peculiar phenomenon is that the motion of the transmitter diaphragm makes the primary current undulate, inducing a current in the secondary of the coil. The induced current going through the receiver causes the diaphragm to vibrate in harmony with the transmitter diaphragm. Much evil results from making this test at subscribers' stations. The subscribers are likely to try it after the trouble man is gone and the howling noise is most exasperating to operators and to the subscribers on a party line.

The Permanent Magnet in the Receiver

Permanent magnets are used in receivers because it has been found that stronger action is obtained when they are used. The diaphragm under the pull of the permanent magnet is much more alert and sensitive than if it were not under tension. Another reason for their use is that telephone currents are alternating, and a diaphragm under tension will move in and out as the current reverses. If no permanent magnet were present, it would normally be flat and would move inward regardless of the direction of the current. The theory of electro magnetism will greatly assist any one who desires to study this action further.

Standard makes of receivers of the permanent magnet type are used on both common and local battery telephones, there being little or no difference in the design. In some cases there may be a difference in the resistance of the receiver used, but most manufacturers now use the same receiver in both local and common battery sets. This, of course, does not apply to the so-called direct current receiver used in some types of common battery instruments.

Some Facts About the Diaphragm

The diaphragm is perhaps the most delicate part of the receiver and its adjustment and condition is extremely important. Diaphragms are so cheap that it is surprising to observe how many telephone trouble men will persist in using a bent or rusty diaphragm or will trim a diaphragm to make it fit a receiver for which it was not designed. Diaphragms are of two kinds, tinned and ferrotype and each one should be used in the make of receiver for which it was designed. Ferrotype diaphragms are ordinarily about .012 of an inch thick, while the tinned diaphragms are frequently twice as thick. The test for separation between diaphragm and pole pieces is made by laying a straight edge across the cup of the receiver with the cap off and observing the air gap and noting that the pole pieces are in proper position. If the adjustment is very fine, the thinner ferrotype diaphragm is necessary and if the spacing is greater a thicker tinned diaphragm should be used. When the ferrotype diaphragm is used the black or finished side should be on the outside.

The next important part of the receiver is the cap, and cap of one kind should not be used on a receiver shell of another kind, even if it seems to fit. The cap not only closes the end of the receiver, and acts as an ear piece, but it is also a clamp for the diaphragm. If the diaphragm is not properly clamped by a cap specially designed for use with the shell, the receiver will be inefficient. After the receiver is fully assembled, the test for proper adjustment and vibration is to tap the diaphragm lightly with the little finger. A clear resonant sound should be heard, indicating that the diaphragm is not frozen to the pole pieces or loose or buckled. If frozen to the pole pieces, the sound will be hard and dead. If buckled or loose, the sound will be hollow. All receiver caps should be screwed up tight. Dust on the end of the magnets or particles of rust on a diaphragm will produce sputtering or cut-outs, as the dust or particles bridge the air gap and interfere with the vibrations. Dirt between the cap and diaphragm interferes with vibrations and accounts for many cases of trouble known as "subscriber cannot hear." This trouble frequently results from hanging the receiver upside down.

The primary requirements in a good receiver are maximum loudness and clearness with minimum distortion. Its efficiency depends upon the following factors; the strength of the high frequency current through the windings, the number of turns in the winding, the length of the air gap, the area of the pole pieces, the permeability of the iron, the strength of the permanent magnet, the size, shape, weight and stiffness of the diaphragm and the design of the airchamber. The coils around the pole pieces are made oval or oblong so that the attraction of the diaphragm may be as near the center as possible.

The Receiver as a Transmitter

If two receivers are connected up together by means of a wire, one may be used as a transmitter. The vibration of the diaphragm in one receiver caused by speaking into it changes the number of lines of force and an electromotive force is induced in the coils of the sending instruments. This will

* Editor's Note: Data Sheets QQ-30-20 and QQ-30-21, published in May, 1923, issue, pages 35 and 42.

cause current to flow in the closed circuit and hence through the coils of the receiving end. The varying current will, in turn, cause changes in the magnetic field of the receiving instrument and the voice waves will be reproduced.

The elasticity of the diaphragm is a very important feature in producing satisfactory speech reproduction. When a very elastic diaphragm is used the voice seems clear and high pitched. When a less elastic diaphragm is used the tones are deeper and more hollow. In designing diaphragms a choice must be made between clearness and loudness, as both cannot be had in one and the same instrument, the former being usually selected. In the construction of coils, owing to the small space available, very fine silk covered copper wire about 5 mills in diameter is used. The resistance will vary from 80 to 112 ohms in different types. In common battery circuits if the receiver is used in series with the line—poor practice—it will have to be poled; that is, connected so that the current on the line will have a tendency to strengthen the magnetism. Recently some trouble has been experienced with certain makes of receivers due to their becoming demagnetized very easily. When such is the case they should be returned immediately to the manufacturer. Many people are very careless and do not realize that jarring is one of the causes of loss of magnetism, as this causes the molecules of steel to become disarranged from their uniform position which they assume when in a magnetic state.

Magnets may be recharged by removing them from the receiver and winding several layers of No. 18 insulated wire around them. This winding is connected with a source of direct current, obtained from a lighting circuit or by connecting a number of cells of battery in series to secure sufficient voltage. If the electric lighting current is used, it is well to place fuses and switch in series with the circuit so as not to blow the main fuses on the lighting circuit.

The Magneto Generator Is a Small Dynamo

The magneto generator is really a small dynamo. It consists of an armature revolving between the poles of three or more permanent horseshoe magnets. This armature must contain the proper amount of iron and the air gap between the pole pieces should be as small as practicable, allowing for proper mechanical clearance. The winding space should be sufficient to permit proper voltage for a given current output. The number of turns should be as few as possible, but sufficient to obtain the required voltage. One connection of the armature usually goes to the metal frame and the other is insulated. The ordinary magneto generator produces a current which is said to be alternating because part of the time it flows in one direction and the remainder of the time in the other, changing in value continuously. This is caused by the fact that the wires on the armature cut the lines of force at various rates of speed. In a complete revolution of the armature, current sent out to the line increases in value from zero to a maximum and then decreases until it again reaches zero. Its direction then reverses and also a similar increase to maximum and decrease takes place. Each of these reversals is known as an alternation; hence there are two alternations per revolution or per cycle. If one direction is called positive, then the other is negative and currents flowing in the conductor are known as positive and negative currents. In the hand generator driven at an average speed the current has been reversed thirty-two times per second, thus producing a current having a frequency of 16 cycles per second.

Current and Voltage of Hand Generators

A generator for rural service tested by an alternating volt-meter should give from eighty to one hundred and ten volts when operated at an armature speed of approximately one thousand revolutions per minute. The voltage of the generator may be tested by using an ordinary 110-volt 16-candlepower carbon lamp connected directly across the terminal of the generator. If this is not available a 25-watt Mazda lamp will probably serve the purpose, although the carbon lamp is to be preferred. If the lamp glows brightly when the crank is turned at the normal rate, it is reasonably safe to assume that the generator is O. K. One of the laws of magnetic induction is that a conductor moving with constant speed in a uniform magnetic field generates pressure, depending upon the rate at which the lines of force are cut by the moving conductor. Hence with a uniform rate of speed constant voltage should be obtained.

Generator armatures are usually wound to resistance of 500 ohms and have about 4,500 turns. They may be wound for special work, in which case it is customary to state the resistance through which it is desired to signal and whether it is to be used for bridging or series work. The magneto generator is usually the same for bridging and series work but the arrangement of the spring cutout on the magneto is different in each case.

Pulsating Current Generators

Although the current in the armature of the magneto generator alternates with each half revolution some generators are so arranged that unidirectional pulsating current may be obtained. The point on the end of the armature is so constructed that one-half is connected to the armature and the other half is insulated. By placing a split spring on top, a direct current is obtained. By placing one-half on top and one-half on the bottom an alternating current is secured. This arrangement is shown in Fig. 3. This type of generator has been used in ringing polarized bells.

Fig. 3

Weak Generators

Generators weaken with age and use. Loss of power is usually due to one of four causes: weak magnets, magnets not properly poled, short circuit in the armature or wrong connections on the shunt. Frequently it is found that a weak generator will ring its own bell but will not call the distant station. Magnets may be remagnetized like other magnets, but the writer has found that it is best to replace the weak magnet with new ones and see that they are properly poled. There is a punch mark on each magnet and they should be arranged with a punch mark on the same side which is usually the front of the magneto. The punch mark is usually located on the tip of the horseshoe magnet. All the poles on the same side of the magneto must be alike. Otherwise there will be a neutralization of the magnetic field. Remember the rule unlike poles attract each other and like poles repel each other.

Miscellaneous Remarks Re Generators

Frequently magnetos are known as or called 25,000 ohm or 50,000 ohm magnetos. When this term is used it is intended to mean that the generator will ring its own bell through the resistance specified.

Bridging generators are designed for heavy current rather than high pressure, as they are used to signal apparatus arranged in multiple. Series generators are designed for high voltage output as they are intended to signal apparatus connected up in series.

Generators are sometimes designated by the number of bars. This is meant to indicate the number of magnets of which the magneto is composed. Thus, three, four or five bar generators mean generators with three, four or five magnets.

The current output of magneto generators is usually very low as can be seen from the fact that a six bar 100,000

ohm generator has an output of above 120 volts and 26/100 of an ampere. The power output is equal to about 31-⅓ watts.

Magnet steel is a certain grade of steel which has been demonstrated as best adapted for holding its magnetism. It contains the sulphur, carbon, silicon, manganese and phosphorous. When they are properly proportioned good magnet steel is produced. The usual temperature for hardening steel is a cherry red, but this depends somewhat upon the kind of steel under treatment. High carbon steel requires the least heat. There are many hardening fluids of which mercury is the quickest, then brine, water, and rape seed oil in the order named.

To magnetize the magnets of a magneto while in position, it will be necessary to use about 300 turns with a current of one ampere through the magnetizing coils. If two amperes are used, then 150 turns will be sufficient.

The output of a magneto generator is proportioned to the number of magnets used. Assuming that a five bar generator has an output of one-half ampere, a four bar will give about four-tenths. The advantage of a five bar generator is that it delivers more current than a four bar, but it is only necessary for heavy rural lines.

Bert Ogden Heads Kellogg Columbus Staff

Columbus, Ohio.—Bert A. Ogden has been placed in charge of the Columbus office of the Kellogg Switchboard & Supply Co. Mr. Ogden is going to carry on the same plan of sales co-operation that has been so successful ever since the opening of this branch office.

Mr. Ogden comes from Salina, Kan., but five years of contact with telephone men of Ohio have made him a Buckeye telephone man. However, although he knows telephone conditions in Ohio probably as well as anyone, his general experience particularly fits him for this wider field of work.

The new Columbus manager of the Kellogg company has held about every position in operating telephony, from office boy up and has also had a wide experience in the selling end of the game. While his home has been in Wilmington until last year when he moved to Columbus, his constant traveling in the state has given him a wide business acquaintance. Mr. Ogden's present address is at 464 West Fifth avenue, Columbus.

A. T. &T. Co. Has Best Year in 1923

New York, N. Y.—American Telephone & Telegraph Co. ended its best year, December 31, both from the standpoint of earnings and growth of business. It is estimated that earnings for the year will be about $11.42 a share on $715,454,300 average stock outstanding for nine months ended September 30, which compares with $11.14 a share on $594,009,500 average stock for 1922. There was a slight increase in outstanding stock as of December 31, but not sufficient to materially alter the 1923 earnings estimate.

Demand for new stations is unabated, and officials expect that the past year's increase will be surpassed in 1924. There were over 750,000 new Bell owned stations put into operation, compared with an increase of 580,176 in the previous year. This means that with Bell owned and Bell connecting stations there is an aggregate of approximately 14,300,000 telephone stations in operation by the Bell system.

The year ended with approximately 280,000 registered shareholders on the American Telephone & Telegraph Co.'s books, which is an increase of about 31,000 in the year. This is exclusive of the 90,000 employes who have bought stock on the partial payment plan.

There are no immediate plans for financing, either by the parent company or its subsidiaries, and any consideration of a new stock issue by the American Telephone & Telegraph Co., will not come up before the summer of 1924 at the earliest.

R-L Moisture-Proof Cords to Show at Minneapolis

Minneapolis, Minn.—At the Minnesota convention to be held at Minneapolis, Jan. 22-24, the Runzel-Lenz Electric Mfg. Co. plans to make an interesting and instructive showing of its moisture-proof tinsel switchboard cord which has attracted so much interest at other state and national meetings. Phil Lenz will be in charge of the exhibit, which will be held in Room 614 of the West Hotel, convention headquarters.

Cable Splicing Champs

Before Big Crowd Chicago Cable Splicers Compete—Contest Details

Chicago, Ill.—Splicers' and Helpers' Local No. 1 of the North District, Chicago, with a score of 95.12, won the splicing and wiping championship of Chicago in competition with Local No. 2 and Local No. 3 of the South and Central Districts respectively. The contest was the first of its kind ever staged in the Bell System. It was held in the First Regiment Armory, Sixteenth street and Michigan avenue, Chicago, and was witnessed by a crowd of approximately 3,500 enthusiastic spectators. The sale of tickets had to be stopped several days before the contest in order not to overtax the capacity of the armory.

The contest was put on at 9:15 p. m. and to watch a demonstration in actual practice of splicing and wiping joints on a cable was a sight long to be remembered by all present.

The section showing the Educational Exhibits was one of the striking features of the show and the different subjects introduced showed the physical set up as encountered by the men in the Plant Department in their every day work. The manhole with the arrangement of cables, standard hangers, etc., was an exact reproduction of the typical conditions met with by the splicer and helper and the standard pole line, with cross cable, junction box arms, etc., was true to life. The set-up of the 600, 900 and 1,200 pair cables showing the four different operations to complete, presented a very effective picture and showed the efficiency in the make up of large unit cables. The different cable forms with connecting building terminals brought out that phase of the work and showed the engineering required to meet the difficult angles encountered in providing efficient service in all kinds of buildings.

This championship contest came about from a discussion which arose in the South Side Local on the night of January 5, 1923, as to who was the best splicer and metal man in that local. At the beginning of this discussion it was not taken with any serious thought. After several members had talked on the subject and brought out the interesting features it would create it was finally decided to hold the contest and different committees were appointed to draw up the necessary rules to govern it. To begin with the novelty of the idea appealed to all the members and their enthusiastic response was an outstanding feature that meant success. As every member of the local wanted to get into the game, the committee found it necessary to set up a program, so that every contestant should have an equal chance and rules were drawn up accordingly. On account of the number of entries it was found necessary to divide the teams into two different classes, one class of splicing and wiping of over two years' experience and the other class of less than two years' experience. The number of contestants made it necessary to subdivide them into five different groups of twelve each and preliminary contests were held every two weeks. The winners in each group competed in the semi-finals.

TELEPHONE APPARATUS (QQ-30-23)

The Telephone Receiver

PHONE AND CIRCUIT RESISTANCE. The telephone receiver can be considered as a resistance load on the input circuit, and for maximum results the resistance of the receiver should be equal to the resistance of the input circuit. This equality of resistance can be attained either by suitably altering the actual resistance of the receivers or by effectively altering it by the use of a transformer or induction coil. By the use of a transformer, with the receiver in the secondary circuit, the proper relative resistance of the two sides of the circuit can be adjusted by varying the transformer ratio. This can be described as follows:

Let R=resistance of input or primary circuit of transformer,
r=resistance of receiver or secondary circuit,
m=transformer ratio.
Then, $R=p^2r$, or $r=R/p^2$.

For example, let us assume that the primary circuit or input circuit has a resistance of 4,000 ohms. According to the above, the maximum results with the receivers connected directly into the circuit would be obtained with a receiver resistance of 4,000 ohms. However, by the use of a transformer having a ratio of ten, the same result could be obtained by the use of 40-ohm receivers, as indicated by the following equation:

$R=p^2r=(10\times10)\times40=4{,}000$ ohms.

RADIO PHONES. Phones used for radio reception have normally a very high resistance, owing to peculiar conditions existing in the radio circuits. The resistance of a single phone will range from 1,000 to 2,500 ohms, according to the purpose for which it is designed. In nearly all cases, they are used directly in the "plate" circuit, where in addition to the voice currents there is a steady flow of direct "B" battery current while the set is in operation. Further, there is a considerable percentage of radio frequency or high frequency current in the nature of 800,000 cycles per second passing through the phones or rather across the surface of the windings. The phones in this case are seldom used in the secondary circuit of a transformer.

The resistance of the winding principally affects the voice frequency currents, the effect on the radio frequency waves and the continuous "B" battery current being practically negligible. A resistance in the nature of 1,500 ohms has little effect on the "B" battery current since the flow of this component will average about 4 to 10 milliamperes. The drop is inconsiderable.

While the inductance in regard to voice frequency is very high, its effect on high frequency current is small, first for the reason that the many turns of wire gives a considerable distributed capacity which is effective in bypassing the radio frequency waves, and secondly, for the reason that it is very common practice to install a bypass condenser across the windings. However, the distributed capacity of the phone windings is so great that there is little necessity for an independent bypass condenser and in the majority of cases the receiver can be operated without loss if the bypass condenser is eliminated. Ohmic resistance up to 10,000 ohms has little effect on radio frequency flow, hence the windings interfere but little with this component.

COPYRIGHT 1924
TELEPHONE ENGINEER

COMPILED BY
J. B. RATHBUN

RADIO PRINCIPLES (Z-22-10)

Super-Heterodyne Circuits

GENERAL PRINCIPLES. In any radio frequency circuit, the maximum amplification can only take place over a limited band of wave lengths, hence there is one wave length at which the peak of amplification can be reached. It is for this reason that the usual radio frequency transformers, designed to operate on a range of wave lengths of from 200 to 600 meters, are decidedly inefficient, regardless of what the constructional detail may be. Further, it is not desirable to operate radio frequency amplifiers on the short broadcasting wave lengths, but on a higher wave length in the nature of 5,000 meters.

In short, the most efficient radio frequency amplification takes place on a narrow band of wave lengths on a fairly long wave length, and if we are to obtain maximum results from the various stations, the incoming waves must be reduced to a constant wave length of about 5,000 meters before passing the current to the amplifying tubes and transformers. This is accomplished in the super-heterodyne circuit by means of an independent oscillator circuit which reacts with the incoming radio waves to obtain a resultant wave of constant length.

In the heterodyne the waves from the oscillator circuit are superimposed upon the tuning circuit in such a way that the difference of the radio frequency and oscillator frequency waves gives a final wave equal to that required in the amplifying stages. Thus, if the incoming waves have a frequency of 800,000 cycles per second and the oscillator circuit frequency is 600,000 cycles, we have a resultant frequency of 800,000—600,000=200,000 cycles per second for use in the amplifying stages. As the frequency of the oscillator circuit can be controlled by means of a variable condenser, we can easily reduce the frequency of any broadcasting station to the optimum frequency of amplification.

A second benefit is derived from superimposing the oscillator frequency upon that of the incoming waves, and that is the amplification due to the addition of waves which occur at the same instant in the tuning circuit. Thus, if the value of the incoming wave is one unit in amplitude, and the simultaneous amplitude of the oscillator wave is five units, then the total effective amplitude at that instant is six units. By properly adjusting the relation of the oscillator circuit to the tuner circuit we can get high amplification before the rado stages are reached. The addition of feed-back regeneration still further increases the signal strength in the primary circuit.

Any number of radio and audio amplifying stages can follow the tuner-oscillator circuit, and as high as seventeen tubes have been operated successfully. With ten tubes wonderful range and selectivity are had, far surpassing any other circuit known at the present time. In the average set it is the practice to use four stages of radio frequency, second detector tube, and three stages of audio amplification. It should be noted that two detector tubes are necessary, one in the tuner circuit known as the "frequency changer," and one detector immediately following the radio frequency stages.

The controls are relatively simple, consisting of the tuning (secondary) variable condenser and the variable condenser used for the control of the oscillation frequency.

COPYRIGHT 1924
TELEPHONE ENGINEER

COMPILED BY
J. B. RATHBUN

How Mexico Fights Pole Rot

Pole Preservation Gets Intensive Study from Mexican Telephone Engineer — Discusses Various Methods of Protection at Groundline—Tells of Concrete Pole Socket

By Helge Rost

(Chief Engineer, Empresa de Telefonos Ericsson S. A. Mexico D. F.)

The annual consumption of wooden poles for telephone, telegraph and power lines in U. S. A. and the rest of the world is increasing every year, partly on account of the tremendous growth of new subscribers to public utility enterprises and partly on account of the continuous replacement of already existing poles.

Even if there were a government law regulating the supply of timber and prescribing a rational replanting of cut down timber the ever increasing demand of wood will heavily drain the supplies and in the same measure as the demand increases the prices will soar.

A. J. Wallis-Tayler, in his book "The Preservation of Wood," makes the statement that 80 to 85% of all wood is lost by decay; the ravages of insects, fires and mechanical destruction account for the balance. In U. S. A., where a comparatively few years ago the supply of timber seemed all but inexhaustible, the amount of lumber now available hardly meets the ever increasing demand in a satisfactory manner. This is due to careless lumbering, failure to replant denuded areas and to the enormous waste caused by forest fire.

There is a great desire of all pole users to get as long a life as possible out of the poles bought, thereby lessening the depreciation rate and their operating costs of maintenance and repairs.

It is of the greatest importance from both national and private economical viewpoints to increase the length of life of wooden poles, and for this purpose many different systems have been used with more or less results.

The Process of Decay

The decay of wood is caused by the growth and activities of fungi at a certain degree of moisture and in presence of air. If heat is present the action is accelerated. All wood in direct contact with the ground, which always holds considerable moisture, is specially exposed to fungi, as these to a great extent live and thrive in the soil. Every user of wooden poles will notice that it is **exactly at the ground line and below it** that a pole starts to rot, as there the three of the beforementioned fundamental conditions exist for the growth and activities of fungi, viz.: wood in direct contact with earth, moisture and air.

Editor's Note: Readers will find a number of things of interest in this article by a telephone engineer from our sister republic of the South. The author's suggestion of a concrete socket in place of the usual earth setting of poles will, no doubt, cause some discussion. Perhaps some of the outside plant engineers on this side of the Rio Grande will make a study of this suggestion to see if it is applicable here where labor and material costs are different and where abnormal loads due to sleet must be taken into account.

The minute spores of one of these fungi germinating on a piece of wood send out threads, like cob-web, invisible to the naked eye, which enter by cracks in the sapwood. Soon a complex compound is formed which acts as a ferment and which dissolves certain parts of the wood fibres. The dissolved fibre serves as food for the fungi. The threads are multiplied by branches and the ferment changes the physical and chemical properties of the wood, rendering it of a brownish color, at the same time decreasing its strength. With other words the wood starts to rot, and when once started the process continues rapidly.

Wood will last indefinitely if protected from the action of these fungi, or even if they are present, but lack the conditions necessary for their propagation.

Apart from ordinary circumstances the fungi, in order to thrive, are in eminent degree dependent on a certain percentage of moisture. We know, for example, that timber, kept perfectly dry or completely immersed in water, will keep for ages. The reason is that in the first case its content of moisture is too low and in the latter case the same is too high to allow the fungi to live. In the latter case the air is excluded besides, which still more prevents the fungi from existing.

According to Johan Edén, of the Swedish Government Forest Service, in an article published in 1922, in the bulletin "Skogen," the minimum percentage of moisture under which the fungi grow with difficulty, is found to be 18%, while above this limit they develop with facility.

Generally, wooden poles above ground contain less moisture than the above limit, and it is only the rain water that now and then tends to increase the moisture content.

If thus the portion of the pole above ground generally does not contain enough moisture to make fungi thrive, such is not the case with that part of the pole at the ground line and below. On account of water always contained in the soil, the pole here absorbs a high percentage of moisture that will just suit the development of fungi, and which percentage will keep nearly constant for great lengths of time.

Importance of Seasoning

Sap confined in timber ferments, causing dry rot. Acording to V. Petrin —Mitteilungen über Gegenstände des Artillerie—und Genie-Wesens, 1898— sapwood is more liable to be attacked by dry-rot than heart-wood; dry wood is found to offer a greater resistance than wet wood; timber from trees felled in winter is less liable to be attacked than that from trees felled in summer. Coniferous woods are much more liable to be attacked by the fungi of dry-rot than the woods of leaf-bearing trees.

We know that where beams are enclosed air-tight in brickwork, etc., or where green timber is painted or treated with creosote, etc., the pores of the wood are sealed and the sap, instead of escaping through the natural means of drying, is contained inside the pole, where fermentation soon takes place, and the wood destroyed very rapidly, although its firm outside shell may give it a deceptive appearance of strength.

The sap should therefore first be removed by seasoning, which should be carried on as far as possible before the timber is painted or coated with other protective composition, or subjected to any preservative treatment. Seasoning takes place by drying the wood in air at natural or higher temperatures or by first steaming the wood under

pressure so as to vaporize the sap, and then removing the latter by means of a vacuum.

Thorough seasoning of large timbers in dry air at ordinary temperatures may require years. On the other hand, too rapid kiln-drying cracks and weakens the wood. But it is questionable whether steaming and vacuum remove the sap as thoroughly as do the slower drying processes.

Preservative Treatments of Wood

The desirability of employing some efficient process for the preservation of wood is now universally admitted, consequently the importance in the industrial world of such treatment is thoroughly recognized and the use of preservative treatments is rapidly increasing.

Wood to be treated should be of such a character to receive impregnation at least through the sap-wood and when the heart-wood cannot be impregnated it should be in itself resistant to decay.

Timber to be treated should therefore be felled in winter, when the sap has ceased to flow and consequently contains less of same.

A. J. Wallis-Tayler makes the following statement in his book, "The Preservation of Wood," page 91: "The wood to be treated should moreover be in a proper condition, that is to say, properly seasoned, or at the very least half-seasoned. In the best practice in Europe the wood is not treated until it has been **seasoned from six to twelve months.** In the U. S. A., however, wood is frequently treated four to six months after cutting, but generally with inferior results."

According to specifications for butt-treating of cedar poles in open tanks, adopted by Western Red Cedar Association, March 15th 1916, poles shall be considered seasoned if they have been properly piled for the period of four seasoning months.

A committee appointed in 1915 by American Wood Preservers' Association made the following report: "A determination of whether wood is sufficiently air seasoned for efficient treatment may be based on moisture extraction from borings which should show an average of not over 20% moisture in relation to the oven dry weight of wood."

Taking into consideration that green wood dried in oven still contains a considerable amount of moisture the above limit of 20% is far too high to permit a satisfactory preservation. The moisture and sap retained in the timber after any kind of treatment, that closes up the pores of the wood, will facilitate dry-rot and shorten the life of the timber.

There are a multitude of preservation treatments of wood, but as detailed discussion of them fall outside the scope of this article, the writer will shortly mention the most common in use. **The open tank hot creosoting process,** is used mostly for butt-treatment of poles, etc. Creosote oil is heated to about 150 degrees F., allowed to cool, heated again, etc., alternately, until enough penetration is obtained.

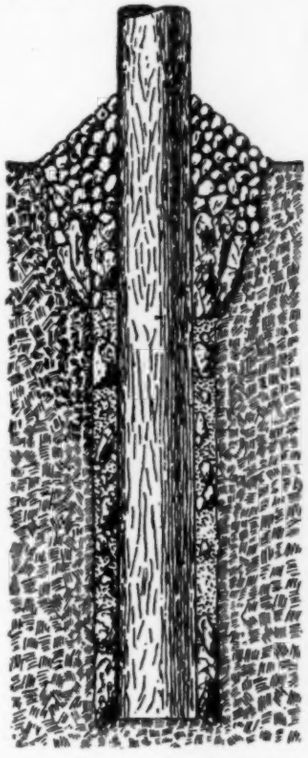


Fig. 1. Swedish method of setting poles to protect against decay

The latest development in butt-treatment is the Pextrex method, whereby the poles are punctured at the ground-line with steel points, and just at the right distance apart to permit maximum penetration of the preservative oil. It is claimed that the sap-wood on account of above mentioned puncturing theoretically loses 8% of its strength.

In actual practice the writer believes the loss will be much greater. As it is the sap wood of a pole that has to resist the heaviest strain, it is not prudent to decrease the original strength of a pole by puncturing at the point where it will experience the heaviest strain and at the same time be exposed to attacks of decay.

Creosoting Pressure Systems

There are several processes using heavy creosote, or dead oil of tar, which is pressed into the fibers of the wood under a temperature of 212 to 266 degrees F. and under pressure of 100 to 180 lbs. per square inch. If not carefully done these timber-preserving processes are however practically useless. **The Bethel creosoting process** is the old standard one. **The Boulton process** is similar, while **the Rueping process** differentiates from the other two methods by using far less creosote and was primarily devised with the object of reducing the cost of creosoting by preventing the heavy loss occasioned by dripping, when the wood is treated by the ordinary process.

Another way of cheapening the creosoting process occurred to Mr. S. H. Collins of Armstrong College, Newcastle-upon-Tyne, by using **saponified creosote,** adding ¼% of caustic soda, after which creosote can be diluted to 50% of its original strength is reported to give excellent results as regards penetration by the open tank method. With this method it is, however, possible that the creosote will be leached by water by and by.

Other processes mostly known are: **Kyanizing,** by soaking the timber in solution of bichloride of mercury. This process is rather expensive. **Burnettizing** using a solution of 2.5% of zinc-chloride and 97.5% of water, which is forced in under pressure. **Sulphate of Copper process** using 10% solution, which also is forced in under pressure at the butt-end.

Mechanical Means of Protection

Owing to the fact that decay always starts at the ground-line and below it every attempt has been made to prevent rotting at these points.

For setting of poles the Swedish Telephone Government Service issued in 1902 the following rules:

"The pole shall be wedged with big stones at the bottom of the hole and about 150 m/m below the ground-line. The space between is filled with stones and gravel.—**It is very important for the life of the pole that it does not come into direct contact with earth nor vegetation.** On this account shall from 150 m/m below the ground-line be surrounded with small stones, which also shall be heaped above the ground-line to a height of at least equal to the diameter of the pole." Fig. 1 shows this arrangement, which helps quite a bit to protect the pole as the stones facilitate drainage and allow the air to circulate. By and by, earth will collect together with rain-water around the lower part of the butt and rotting will start anyhow.

Setting Poles in Concrete

Many patents have been taken out for protecting wooden poles at the ground-line, but all have made the mistake to hermetically seal the wood by setting it in concrete or other material thereby preventing escape of the moisture retained in the butt and thereby creating the most favorable condition for the growth of the wood-destroying fungi. Others are trying

to save poles rotted below the ground-line by casting a heavy collar of concrete with reinforcement around the rotted part, not knowing that the collar will hasten the decay of the already infected wood.

If a pole of a pole line must be changed on account of decay below ground, never put the new pole in the hole of the old one, nor close to same, as the fungi there will be abundant and at once attack the new pole.

Base-Support for Wooden Poles

The writer has for many years studied the decay of wooden poles and found that they are always **first attacked** at the ground-line or below. His conclusion is that **the only way of giving the poles a long life should be not to put them in the ground.** In fact they should be put above the ground and as far from it as possible.

With this view in mind he designed a base-support of re-enforced concrete as shown in Fig. 2 and 3, of which a patent application No. 671664 has just been filed in U. S. patent office.

A short description of this base-support will undoubtedly be interesting, as it is unique in its application and indicates a new way of prolonging the life of poles indefinitely.

The base-support of which Fig. 2 gives a vertical and cross-sectional view has for one of its objects to provide a base member, having a socket at the upper end thereof for the reception of the butt end of a pole to be supported, the base-support being capable of transportation for use at various points and with poles of different types such as wood or iron.

The principal objects of this base-support is to provide a perfectly rigid seat for the butt of the pole, the lowest point of which will be situated above the ground-line, at the same time keeping the butt perfectly dry and ventilated by air on all sides. These desirable features are arrived at by means of interior longitudinally extending ribs, with air-passages interspaced. The bottom of the above mentioned socket is dome shaped with a highest point in the center and provided with side openings communicating the inside of the socket and corresponding air-passages with the outside atmosphere. This feature serves two purposes:

1. To permit circulation of dry air at all times around the butt, cool air entering through the side openings and passing out at the top of the socket, bringing with it any moisture encountered on its way.

2. To facilitate instant drainage of rain-water entering through the interspaced air-passages at the top of the socket through the side openings above the ground-line. From Fig. 2 will be noticed that there is a solid concrete part in the center of the base-support, the upper surface of which is dome-shaped as stated above.

The object of this solid part is to seal the upper socket from the lower hollow compartment, thereby preventing moisture passing from the sub-soil to the socket above.

From the above description it is obvious that by means of these base-supports a pole line can be built through marsh-lands, a pole can be put in a ditch, etc., without the slightest inconvenience to the wooden pole, that rests dry and snugly in its socket at convenient distance from the water or ground-line.

The inside of the socket can be slightly tapered towards its lower end and in such a case the pole butt should be trimmed accordingly. This arrangement could with advantage be used when setting green poles as they when drying decrease in diameter and will then adjust themselves automatically to the base-support by simply sliding further down, if space from the beginning is left at the bottom of said socket. Even if the pole butt rests directly upon the dome shaped solid

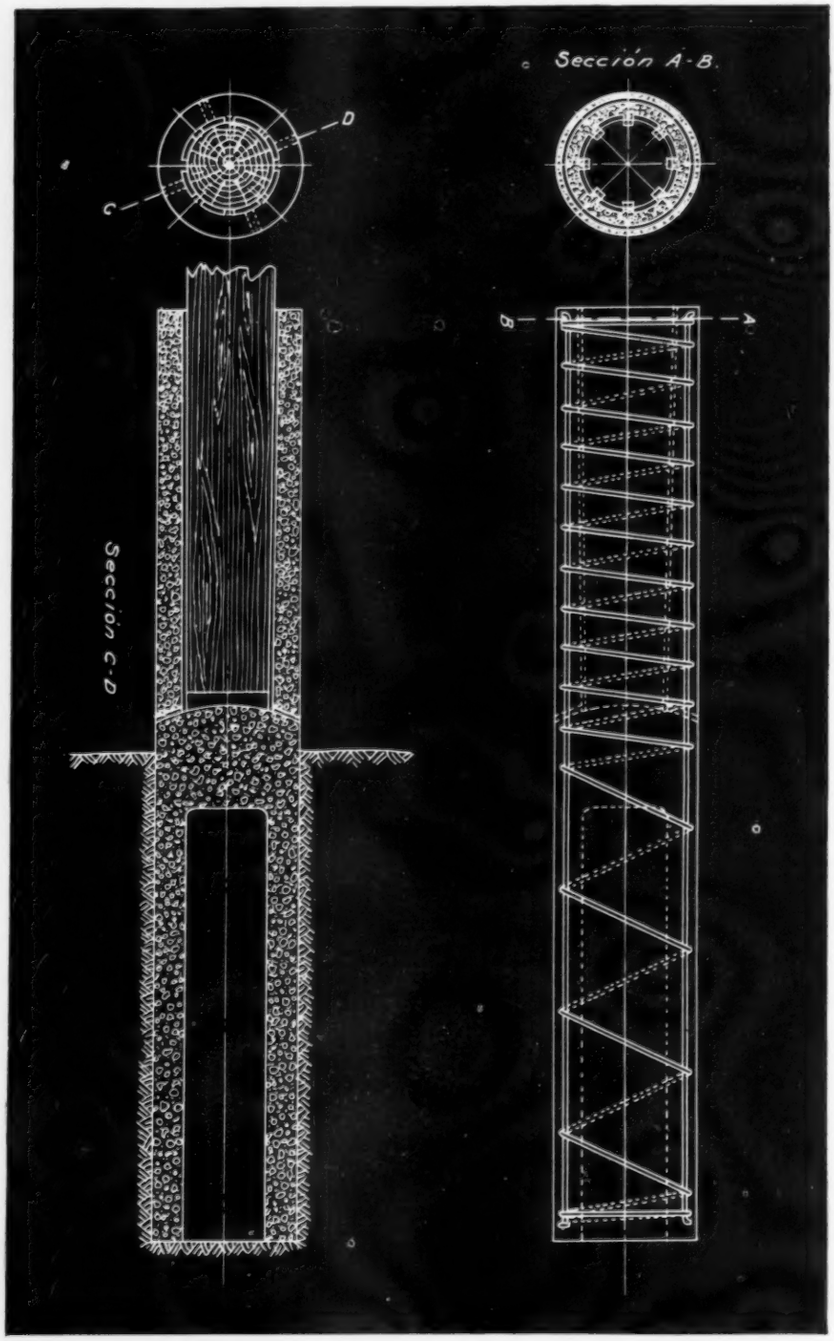


Fig. 2 (left) and Fig. 3 (right). Details of re-inforced concrete base support invented by Mr. Rost

part, air will still circulate as before and water will escape.

The base-supports are conveniently manufactured at the yards of any company that may need them, as there the concrete can be perfectly cured, which is of great importance if satisfactory results are to be obtained, from there they may be transported to any place where needed. Being of light contruction the base-supports are not very heavy and can be easily moved from one place to another and can moreover be used over again, should a pole be moved to another place.

Fig. 4. Concrete base support ready cast in mould

If a wooden pole is rotted away at the ground-line it can be cut off right there, trimmed and placed in the base-support, without losing its original height, and if the pole was only partly infected by dry-rot in its upper part it may still stand for several years, after which time a new pole can be placed in the same base-support.

Figures 3, 4, 5 and 6 show supports in various stages of manufacture.

Advantages Obtained from Using This Kind of Base-Supports

1. Preventing direct contact of a wooden pole with the soil and the ground-line, heretofore fatal to its health, life is prolonged indefinitely. We know that timber used in houses, block-houses, etc., lasts for ages if properly taken care of.

2. The cost of such base-support

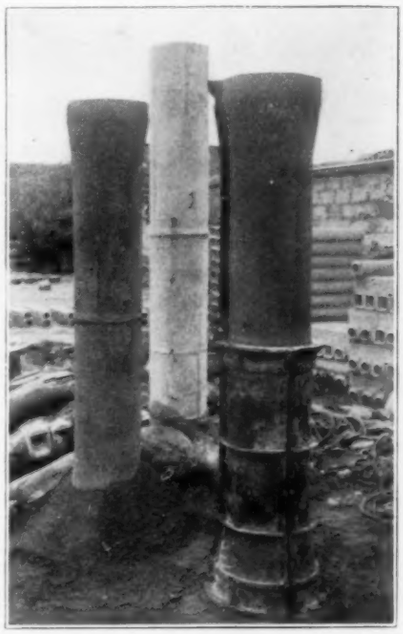


Fig. 5. Different kinds of base supports. The one in front has its mould just taken off.

is not out of the way even for smaller users of poles, as the first outlay will amply repay in the long run.

3. Will facilitate figuring of depreciation funds for same kind wooden poles, as with this base-support it is immaterial in what kind of soil it is set. If a pole is set directly in the ground, it will have a different life depending on the kind of soil.

4. The base-support is easily transported on account of its light construction, and will give pretty nearly the same service as a heavy concrete pole, the use of which is prohibitive both in cost and handling.

Fig. 6. Water is let into the upper socket by means of a hose and same water is seen making its escape through the four holes at the bottom of the socket

5. It can be used repeatedly and changed without inconvenience from one place to another.

6. The base-support will lower the first cost of the wooden pole as now it does not need to be as long as before, nor as heavy at the butt, as there is no need of buying extra wood to allow for rotting at the ground-line. In U. S. Forest Service Bulletin 84, page 38, the following statement is made: "It is the practice in pole specifications to require poles of larger diameter than the actual service requires, in order that a certain amount of deterioration by decay shall be allowable before replacement is needed."

7. A pole only rotted below or slightly above the ground-line can be saved by cutting it off, and using a base-support without changing the wires nor lowering their height, thus saving time and labor.

8. The strain on a wooden pole provided with base-support will be less, than for a pole without such support, as the critical point in the former case will be considerably above ground. The base-support can of course be made of any desirable strength at the ground-line, and this strength will improve with years. A wooden pole placed in the ground will on the contrary decrease in strength as the years pass by.

9. The base-support will help conserve the natural timber resources of any nation.

Ref.: A. J. Wallis-Tayler, "The Preservation of Wood." John C. Trautwine, "The Civil Engineer's Pocket Book." Johan Edén, "Skogen," Underhåll av Trästolpar.

Fig. 7. Base support taken out of the mould being cured in wet sand. Notice the ribs of the upper socket for ventilating. To the left a wire reinforcement is seen

Shape U. S. I. T. A. Plans

Executive Committee Meets at Chicago

Chicago, Ill.—Auditors are to lead off in the organizing of Class A company experts into groups that will give the entire industry the advantage of their abilities.

This was determined at the meeting of the executive committee of the United States Independent Telephone Association held at Chicago in December.

Organization of the auditors followed the approval by the executive committee of the officers' plan for an intensive study of the financial status of the association's member companies. Units of comparison and uniform distribution of expense are to be agreed upon as the foundation of the work.

Class B and Class C member companies will hold regional meetings at the headquarters of Class A companies for considering financial and other problems. These meetings will be executive sessions to obtain definite and accurate information as to their financial requirements and the operating conditions.

In February the first session of the Class A companies will be held. Companies of the major class will be represented by their presidents and general managers, or by both, and by their auditors. President G. W. Robinson of the Tri-State, of St. Paul, has tendered the services of his accountants and commercial engineers, and will present to the meeting a suggested analysis of accounts and units of comparison for adoption by association companies. A comparative statement of all Class A companies also will be presented by Mr. Robinson, which will supply the basis of discussion.

J. C. Paxton, President's Assistant

J. C. Paxton, Sherman, Tex., assistant general manager of the Associated Telephone Companies, has been appointed assistant to President MacKinnon. Mr. Paxton's accounting and general operating experience qualify him for the duty of collecting and compiling statistics to be used in working out the association's plans for help to its member companies.

Another important personnel appointment announced at the Chicago executive conference was that of A. L. Staderman, Terre Haute, chief engineer of the Citizens' Independent Telephone Co., Terre Haute; Kinloch-Bloomington Telephone Co., Bloomington, Ill., and the Wabash Valley Telephone Co., Paris, Ill. Mr. Staderman was named to serve as the Independents' representative on the telephone group of the American Engineering standards committee. Mr. Staderman will be the Independents' engineering representative at all technical conferences involving the standards committee and the U. S. Bureau of Standards.

A meeting of Class A engineers and plant experts is to be held in the near future, at which Mr. Staderman will confer with the engineering men on matters which will concern the association's recommendations to the standards committee. This will be the initial activity of the Independent association's group of engineering experts, which eventually will function for the benefit of all member companies.

The Iowa Independent association is sending out questionnaires to determine the advisability of organizing a finance division in the Iowa association, which will put into effect the so-called Texas plan of financing. The executive committee approved the Texas plan where the operations of the companies are such that the amortization plan can be followed. The committee instructed the association officers to take up with state executives the matter of organizing finance divisions to operate under the Texas plan, with co-ordinated methods and forms to promote general salability of securities.

Class A traffic superintendents are to meet to consider long-distance toll rules for presentation in a standard book of practice.

Independents propose to meet with Bell and National Electric Light Association officials to discuss telephone company protection from high tension interference. The Independents believe that their only protection lies in legislation.

Advertising to Get Brisk

The association is to provide each member with a plate carrying a standard Independent design for use on letterheads and other printed matter. Signs for toll stations are to be prepared. A general campaign of brightening up and making more extensive Independent advertising was outlined by the executive committee.

In addition to the $5 membership fee, member companies are to contribute to the association seven-hundredths of 1 per cent of their gross revenue in order to carry out the financing and organization plan of the association.

Coffey System Moves Into Larger Quarters

Indianapolis, Ind.—Coffey System and Audit Co. has moved to 607 Peoples Bank Bldg., Indianapolis, due to the rapid growth of the Coffey central accounting department, and its consequent demand for larger space. The Coffey system will open a branch office in Iowa the first of the year to handle the billing and subscriber ledger work in connection with the central accounting department.

Carpenter Becomes Gen.-Mgr. of N. Y. Telephone Co.

New York, N. Y.—Henry C. Carpenter has been made General Manager of the New York Telephone Co. Since 1919, Mr. Carpenter has been chief engineer. He now will be in charge of the company's operations. Mr. Carpenter is succeeded as chief engineer by George W. McRae, of Chicago, Chief Engineer of the Illinois Bell Telephone Co., who formerly was toll traffic engineer of the American Telephone & Telegraph Co. in New York. After graduation from Columbia University in 1899, Mr. Carpenter entered the engineering department of the New York Telephone Co. and rose by successive steps to the post of engineer in 1912, holding this position until 1919, when he was appointed chief engineer. Mr. Carpenter is forty-five years old and a resident of New York.

E. M. Powell Resigns as Dallas, Tex., Manager

Dallas, Tex.—Edmund M. Powell, since 1908 active in the Texas telephone business, has resigned as manager of the Dallas Telephone Co. to become associated with the Investment Finance Corp. of Dallas. Mr. Powell joined the staff of the Fort Worth Telephone Co. in 1908, and after three years' service at Fort Worth joined forces with John C. Casler, who then was organizing the Dallas Automatic Telephone Co., which later merged with the Dallas Bell property to become the Dallas Telephone Co. Mr. Powell served several terms as treasurer of the Texas Independent Telephone Association.

Southern California to Spend $19,200,000 in 1924

Los Angeles, Cal.—According to A. H. Griswold, vice president of the Southern California Telephone Co., $19,200,000 will be spent for extensions in 1924. The installation of 60,000 new telephones in 1924 is expected.

Arthur C. Woodward Named Manager at Greensburg, Ind.

Greensburg, Ind.—Arthur C. Woodward has been appointed manager of the Decatur County Independent Telephone Co. property at Greensburg. S. D. Perry, present manager, continues as a director and in an advisory managerial capacity

Interesting Cases

Missouri Commission Returns Findings of General Application in the Telephone Field

The Public Service Commission of Missouri recently decided three telephone cases of importance as bearing on similar questions raised in all parts of the country:

Case No. 3767 was that of William Rohlfing et al. vs. Charles Jackson. Mr. Jackson is owner of a telephone exchange at Belle, Mo. Mr. Rohlfing and associates own a Mutual Telephone System, having no direct connection with the exchange at Belle. August 1, 1921, the Belle Telephone Exchange submitted to the Missouri commission the following rules governing the switching of rural lines which were in effect on the date of the complaint:

"Switching service will be furnished to lines as a whole only, and the service line is furnished when payment is made for the entire number of subscribers on the line. Service will be discontinued to the line as a whole when any part of the charges are due and unpaid. The use of switches, call bells, extensions or other devices whereby other than subscribers are allowed to receive or transmit messages over the lines, or through the central office of the Belle Telephone Co. are prohibited. Any person violating this rule will be refused service." (Charles Jackson vs. Farmers Telephone Co. et al., II Mo. P. S. C. 404.)

The complainants objected to the rules and insisted that they should have physical connection with the exchange on the basis of twenty cents per call for any member or owner of a telephone on their existing line. The commission after investigation of all the facts dismissed the complaint of Mr. Rohlfing and associates.

The second case was No. 3784. A. H. House vs. Johnson County Home Telephone Co.

The complainant in this case is manager of the Knobnoster (Mo.) Mutual Telephone Co. Defendant also maintains an exchange at Knobnoster. The complainant made application to the Johnson County Home Telephone Co., requesting installation of a telephone in his place of business, stating that he was willing to pay the toll and exchange rates charged other customers. The testimony was to the effect that the telephone of Mr. House was to be used for relaying messages from subscribers of the Mutual company to subscribers of the Johnson County Home —in addition to the regular business calls of the complainant. The complaint was dismissed by the commission, the following extract being from the report:

"The obligation of a telephone company is to furnish telephone service for the subscriber, including his agents, employees, guests and family. To permit complainant, in addition to these uses, to accommodate a large section of the community by interchange of telephone service between defendant's lines and patrons of the Mutual company, would constitute an undue preference. Hence, refusal of defendant to furnish such service is not an unlawful discrimination against complainant."

The third case is No. 3795. H. T. Dannatt vs. Missouri Union Telephone Co.

Complainant resides on a farm two miles from Calhoun, Mo. He is manager of the Mutual Telephone Co. at Calhoun and in addition to these duties is engaged in shipping live stock, and is shipping agent for the Farmers' Club. Complainant applied to the Missouri Union Telephone Co. for a telephone in his office in the same room as the switchboard of the Mutual company. It developed in the testimony that, in addition to the usual usage, the telephone would be used for transferring messages from the Mutual system to the Missouri Union, and vice versa. The complaint was dismissed, the salient feature of the report saying:

"The duty of the defendant to furnish all residents of the community which it serves with telephone service upon equal terms, does not obligate it to furnish a telephone for use by a competitor, such as the Mutual company, in transferring messages from one system to the other."

Telephone Buildings

They Differ from Other Structures, Says N. Y. Telephone Company

New York, N. Y.—During 1923, the New York Telephone Co. carried out the most extensive program of its history for the erection of new central office buildings in the metropolitan area. The program involved thirty-six building projects, representing a building investment of about $13,000,000. All of these buildings are of extra heavy fire- and moisture-proof construction, and in the case of new buildings, have foundations capable of carrying twice and often three times as many stories as the initial structure. Fifteen of the thirty-six projects were commenced during the year, eleven being additions or extensions to existing buildings and four being entirely new structures. This summary does not include the new twenty-nine story central office and administration building to be erected by the telephone company on the block bounded by Barclay, West, Vesey and Washington streets, in downtown Manhattan. Only the excavations have thus far been contracted for in this undertaking.

In addition to these projects, the company began a new central office structure in Belleville, N. J., and additions to other buildings in Newark, Orange and Montclair, N. J. Additions to buildings in Hackensack, Asbury Park, Passaic and Union, N. J., were completed during the year. Projects also were carried on at Long Beach and Tuckahoe, N. Y., and a new central office building has just been commenced in Yonkers. In the upstate section, central office buildings were enlarged at Schenectady, Utica and Buffalo. Unlike the ordinary office building or hotel, a telephone building is far from being ready for use when the finishing touch is put on by the contractor. Not until it is thoroughly "seasoned" can installation forces begin the task of assembling the complex central office apparatus and connecting it with the remainder of the city's system. Generally speaking, it requires from two to four years to erect a central office building, install the apparatus and place it in actual service.

Illinois Bell Breaks Its Annual Growth Record

Chicago, Ill.—A net gain of 73,280 telephone stations in 1923 in the territory served by it is the record of the Illinois Bell Telephone Co. All previous records for telephone station growth were broken in the new mark set by the company. The 1923 figure was 13.3 per cent greater than the highest previous year. To obtain this new high mark, the company made a total of 197,361 telephone installations, and discontinued a total of 124,081 telephones. The station gain in Chicago alone was 51,951. At the end of the year the number of telephones in Chicago was 692,645. During 1923 the company spent for extensions to its plant approximately $18,000,000. For 1924, for similar work, the company will spend approximately $19,500,000. In 1922 the daily average number of calls handled by the company was 4,154,931. This was increased to a daily average of 4,635,101 in 1923.

Repeal the Government Tax on Telephone Messages

The Secretary of the Treasury recommends that Congress repeal the act requiring a government tax on telephone messages. The President's message makes the same recommendation. The bill to be presented to Congress now is in committee in process of writing. Telephone managers should, at once, write their Representative in Congress and Senators from their State, urging them to support this bill.

Europe's Year Was Busy One

International Long Distance System Plans Assume Definite Shape—Technical Study on Submarine Cables—High Frequency Telephony on Power Lines—Development Record of Nations

By Bruno Schapira

The numerous administrative and technical difficulties which telephone intercourse between the European states had to go through during the past years showed the absolute necessity of an international European telephone conference. In March, 1923, the first sitting of the International Technical Committee for "long distance telephony," in which France, England, Belgium, Italy, Spain and Switzerland joined, took place at Paris. Only technical subjects were discussed, the idea being that these questions should be preliminary to a general European meeting to be convened later. In order to go into details of the questions, a number of sectional committees were arranged.

First of all came the conclusion that standards for the international telephone connections should be adopted. The electric values for subscriber microphones, subscriber receivers and for subscriber induction coils must be fixed. Besides there is to be a unit for speech transmission. The idea is to adopt the testing method which is in ordinary use in England and to take a mile of the standard cable for measuring the speech transmission. This corresponds to a damping of 0.106 with a frequency of 800 periods. Communication on the lines of the international net is not to be below communication for 32 miles of the standard cable. In case the extent of service does not justify more expensive lines an exception will be made, but not more than an additional damping of 6 miles of the standard cable will be permitted. The use of cable lines for the international lines is requested, but the limit of the distance that can be bridged over by pure cable line in the usual method is supposed to be 1,000 miles. At present there are overhead lines for long distance lines. Thermionic repeaters are to be used for overhead lines as well as for cable lines. The thermionic repeaters are supposed equally to reinforce all the waves in the speech band. In each European country special examinations are being made on trouble due to power circuits.

Submarine Cables Are Studied

This year it was possible to gather experience in Europe with various submarine cables for telephony which helped to a great extent to clear up the question as to whether Pupin cable or Krarup cable should be used. In the first instance there are the cable lines from Germany to East Prussia (two cables each 106 miles long), besides the cables from Germany to Sweden. The cable from Pommern to Danzig, which is 93 miles long, contains 12 telephone lines and 4 double telegraph lines. This cable represents the most important innovation respecting submarine cable telephony. It shows particularly that the demand of speech across land and across the ocean has increased and that therefore it is necessary in many cases to put a larger number of speech channels into one cable.

The results of experience till now are as follows:

If a number of telephone connections across shallow water with sandy ground is to be made, Krarup cables with paper and air-space insulations and lead casings are today considered first of all. The space required for a double conductor has been reduced to about one-third with an equal output. If the sea is deep and stormy and the coast is rocky or there are other circumstances which make laying cables with lead casings and paper and air-space insulation seem inadvisable, two types of cables are available: Pupin Balata cables or Krarup gutta-percha cables. Pupin Balata cables seem to have all the advantages the longer the distance at sea, that is to be bridged. Finally, if telephone cables are to be laid in very deep sea, or if separate connections are to be made, single cables lines à la Devaux-Charbonnel may be used. The characteristics 'of these cables are that single lines are used just as for telegraphic purposes. The copper conductors of this kind of cable are spun with iron-wire after Krarup's proceeding in order to raise the self induction.

Altogether the problem is not yet absolutely solved in which way submarine cable telephony will be executed in the future, when the possibilities given by thermionic repeaters are taken into consideration.

High Frequency Telephony on Power Systems

In various European countries high tension power nets are used for telephonic communication between the electricity stations and substations. For this purpose, alternating currents, the frequency of which is much higher than that of power current are superimposed on the low frequency. There are such telephone equipments in Germany, Sweden, Norway, Switzerland and France. The longest line constructed till now is 84 miles long, and is located in Germany.

The total length of all European high frequency telephone lines may be said to be 440 miles, about 220 miles of which belong to Germany.

Recent Development in England

At present England has 20 telephone lines to the Continent all going from the London Central Exchange. Twelve of them go to Paris, 3 to Brussels, 2 to Antwerp and one each to Calais, Boulogne and Lille (France). All the traffic to Switzerland is conducted via Paris. Thermionic repeaters are used to a great extent especially for transit lines via Paris. Telephone traffic with Germany is to be started afresh by means of a newly built line which is to be carried via Amsterdam to Berlin. The new Dutch telephone cable is 80 miles long and contains 4 conductors with modified gutta-percha insulation. The coils are rolled up in cores of iron-wire and connected in spaces of 1 nautical mile. At present service is kept up only on the lines between London and The Hague, Amsterdam and Rotterdam. The new cable from London to Manchester which is 200 miles long, has 160 pairs of conductors, 56 pairs of which are meant for telegraphing. In Penny Stratford and Derby thermionic repeaters are connected. The cores for the loading coils are made of fine iron powder which is pressed into flat rings by high pressure. This kind of coil has a constant inductivity and is proof against permanent magnetization by calling currents.

Respecting the development of automatic telephony in England it must be mentioned that in 1923 came the decision of the Post Office to install automatic telephones in London, besides

Giving the Telephone Life

Wherever your thought goes your voice may go. You can talk across the continent as if face to face. Your telephone is the latch to open for you any door in the land.

There is the web of wires. The many switchboards. The maze of apparatus. The millions of telephones. All are parts of a country-wide mechanism for far-speaking. The equipment has cost over 2 billion dollars, but more than equipment is needed.

There must be the guardians of the wires to keep them vital with speech-carrying electrical currents. There must be those who watch the myriads of tiny switchboard lights and answer your commands. There must be technicians of every sort to construct, repair and operate.

A quarter of a million men and women are united to give nation-wide telephone service. With their brains and hands they make the Bell System live.

"BELL SYSTEM"
AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES
One Policy, One System, Universal Service, and all directed toward Better Service

numerous small automatic telephone exchanges. The Post Office has contracted with the Automatic Telephone Manufacturing Co. for the supply of automatic telephone exchange equipments for 50,000 subscribers' lines and a large junction exchange for interconnecting the automatic and the existing manually operated system. It is the intention to introduce automatic telephony in all cases having the appearance of being undoubtedly economical. Projects are at hand for automatization of districts containing several exchanges connected with one another. The total number of subscribers connected to the Post Office system is one million. There is now one telephone to each 49 inhabitants of England.

In endeavoring to reduce power circuit interference the British Post Office carefully balances the capacity of the cable piece by piece before joining it, and revolves the overhead conductors either on the twist principle or on the American cross-over principle in which there is less danger of accidental contact.

Automatic Trunk-Line Exchange in Germany

The first automatic trunk-line exchange in the world was opened in Weilheim, Germany, in May, 1923, having at present 300 subscribers. Up to the present only local calls have had automatic telephone traffic. Calculating the rates was comparatively simple as a call was registered on the meter of the calling subscriber for every communication for which a rate had to be paid, independent of the time the communication lasted. If the connection did not take place nothing was registered.

It is more difficult to solve the problems which came up in handling the trunk-line traffic. This is no simple task, as the zones of the exchanges and the time of communication have to be considered. The problem of trunk-line traffic has been solved in following way: Rates are calculated according to zones and time of communication in such a way that they are always a multiple of local rates. The way of putting down the rate on the calling subscribers' account is by turning his communication meter, at the end of a trunk-line communication, a certain number of points onwards, equal to rate marks consisting of zones and time.

In the equipment of Weilheim, first of all, automatic trunk-line traffic is provided, in the interior of a district, the largest zone of which is 15½ miles. All separate telephone exchanges of a district are united in a net group and the biggest and most suitably situated exchange is made into a net centre. Here there are the first group selectors for the whole net so that after lifting up the receiver every subscriber is connected with the net centre by the first and second pre-selector. The circuit selectors are in the sub exchanges. The result of this arrangement is that the lines of the net are grouped in a simple way even if the sub exchanges are far apart, yet the lines can be utilized in an economical way. Besides this the advantage of centralizing the first group selectors in Weilheim is that a uniform subscribers' list can be made for the whole net group. All the lines have two conductors. Feeding of the microphones of the subscribers is always done by the sub exchanges. There is nothing new to say about equipments for the traffic centre of the net group at Weilheim itself. The ordinary Siemens system is used. However the sub exchanges have several innovations which are employed for the first time.

The rate registration may undoubtedly be called the most important innovation. When a subscriber adjusts the group selectors by selecting a number a movable selector fixing the rate of the zone is also set moving. The contacts of this zone-switch make the connection with the time-switch which consists of the two movable selectors. The second one of these movable selectors influences a fourth movable selector which marks off the time and zone switches and sets the meter moving. The automatic arrangements are made from the beginning in a way that the zones can be enlarged as required.

In the course of this year new automatic telephone exchanges have been opened in following German cities: Aachen, with 6,000 subscribers; Leipzig, with 20,000 subscribers, and Dessau, with 2,000 subscribers. Leipzig has now an automatic main exchange, an automatic sub exchange and 5 other sub exchanges, so that the entire local traffic is handled automatically.

The use of thermionic repeaters is of greatest importance for the development of trunk-line telephony. It is possible to reduce the diameters of copper conductors in trunk-line cables by more than half. Besides the distance of transmission is considerably enlarged. In Germany thermionic repeaters are made of lamps standardized with tungsten cathode. The cathode is rated at 1.1 amp. at 3.7 volts. The anode voltage is 220 volts. Two kinds of connections are used. In overhead lines and Krarup submarine cables two-repeater-two-wire connections are used in which case a thermionic repeater has to be switched on for every direction of message. For long cable lines four wire connections are used, which have a special line with a thermionic repeater for each direction of message. With the second kind of connection a much larger distance of transmission may be obtained than with the connections mentioned first. The plan for distributing thermionic repeaters in cables may be seen by the damping coefficients for German cables. Thin wire communication circuits are connected into thermionic repeater exchanges after every 47 miles. In circuits with heavy copper conductors the thermionic repeaters are 94 miles apart. Exchanges in which both kinds of communication circuits are connected are repeater main exchanges. On account of the great number of trunk-lines which are joined in cables today it is necessary to erect special buildings in order to place the repeater equipments. For lines which have not yet been provided with repeater arrangements, repeaters can be fixed at the subscribers' place and can be connected when required.

On account of the want of security of service in overhead lines and of influence by power circuits, particularly by tramways, it is necessary to put both telephone lines and telegraph lines double wired in cables. If the expenses for these purposes are to be kept to reasonable limits there must be a multiple utilization of the lines. Siemens has worked out a new system for multiple alternating current telegraphy which was introduced in the German telegraph system. It enables Pupin lines with the same construction as employed for telephony, to be used for sixfold telegraphy as well. A particular advantage of alternating current telegraphy lies in the way in which it has been worked out by using thermionic repeaters and electric filters. The power of the current employed is only as great as that of the communication currents. It can be reinforced on the receiving system in a simple way. In that way troubles do not occur half so easily on telephone lines compared with telegraphy. The voltage of any frequency is less than 1 volt at the beginning of a cable.

The senders can be operated by any telegraph apparatus and work on the general sender repeater. The currents of the six senders enter the line together and are reinforced by a general receiving repeater. They are then separated by filters, after which they are rectified and conducted to the standard receiver relays. The possibility of utilizing alternating current telegraphy in so many various ways may be the reason of the single high speed telegraph winning the competition with the multiple high speed tele-

Storm-Resisting Poles

A PROMINENT professor of a leading college, commenting on the effects of ice storms on trees, is authority for the statement that conifers stand out conspicuously for their ability to resist storms.

The strong, sturdy pines, solidly encased in ice, easily carry a burden equal to many times their original weight. Other supposedly strong trees failed miserably.

If pine trees best resist the rending force of the icy load, does it not naturally follow that Pine Poles will likewise give the same exceptional service in overhead pole lines under the same kind of stresses?

Nature made them strong—International makes them last

International Creosoting & Construction Co.

General Office, Galveston, Texas

Plants—Texarkana, Texas; Beaumont, Texas; Galveston, Texas

International

CREOSOTED YELLOW PINE POLES

graph. Instead of relay stations there are repeater connections for alternating current telegraphy and the same repeater connections can be used as for telephony. The telegraph official can manage his apparatus in the usual way without having to know if his apparatus is connected with an alternating current source or with a direct current source. In introducing this new system great difficulties arose from the circumstance that there was only a small space of frequency at disposal for Pupin cables, for instance, 400 to 1,700 periods/sec. So 6 telegrams have to be pressed into the narrow space of frequency being 1,300 periods/sec., whereas overhead lines in the U. S. of A. have a space of 7,000 periods/sec.

In large German telephone trunk-exchanges conveying belts driven by electricity are being used for collecting and conveying forms for trunk-line messages. The reversing-belt system in use consists of a conveying belt fixed in longitudinal direction of the record tables which can be moved about in any direction of the room. Its effect is that the co-efficient of friction of paper on a smooth metal surface is about half as much as on fibrous material. If the belts are moved along a metal surface the paper in between is taken along too.

Alternating Current Telegraphy System Developed in Italy

In Italy, single wire Morse-telegraph lines which are laid along various electrified railways are recently being driven by an alternating current telegraph system which makes them proof against troubles by traction currents. The frequency of the telegraphing current is far greater than the frequency of the traction current. Either magnetos with spring driven interrupters or frequency converters act as senders. Polarized relays the armature of which oscillate in the synchronism of the telegraphing alternating current by which means resistance in receiver circuits is reinforced, act as receivers. By resonance connections the telegraphing current only is open to the receiver. This connection may be used for Hughes apparatus as well.

Switzerland Installs Automatic Exchanges

After having shown great reserve in the beginning, the Swiss Telephone Direction is taking great interest in automatic telephone service. For Zurich with 30,000 subscribers, and Geneva with 4,000 subscribers, the Western Electric Company system was chosen. In Lausanne an exchange for 8,000 subscribers is being constructed on the Siemens-Strowger system. It is not yet settled how the automatic telephone exchanges in Berne and Basle, each of which will have 18,000 subscribers, are going to be equipped. It is striking that the small automatic telephone equipment erected the last few years have, without exception, been constructed à la Siemens-Strowger.

Pupinizing four wire lines till now has been done by connecting two sets of coils in both sides of each four wire line. In Switzerland and Luxemburg cables are being used recently which receive the necessary self induction for pupinizing side circuits and four wire lines from the same coil, so that they can get on with one coil for each side circuit. Each half of the ring shaped core of a coil has a winding. The two windings are connected with the conductors of the side circuits so that a field complete in itself is formed in the coil if the connection is switched on the side circuit. With four-wire line connections poles are formed at the end of the windings making a stray field. Now if both the coils are put on top of the other so that the unlike poles are opposite each other the stray fields are caught and one single field complete in itself, passing through the cores of both the coils is formed. This four wire line field produces self induction as required for four wire line connections. The problem how to obtain the required proportions of self induction to one another in four wire line and side connections in any case is solved by fixing additional windings. By abolishing special four wire line coils a great deal is saved. The abolition of dead resistances which are inserted in the lines with double coil sets is of great importance particularly for heavier conductors.

Vienna Uses Semi-Automatic

Ninety thousand, or nearly 70% of the total of 132,000 telephone subscribers of Austria, are in Vienna. Good experiences with the automatic telephone exchange in Graz were the cause of the Austrian Telephone Direction automatizing the Vienna telephone net. A system was adopted which can either be used as semi-automatic or complete automatic. At present semi-automatic service is being given. Nine of the planned exchanges are already working, the other four are being constructed. The semi-automatic exchanges are constructed on a hundred thousand system, that is to say, all the subscribers' numbers are made up of five figures. In the Vienna system the so-called differential-connection enables the pre-selector to approach up to 18 of the first group selectors, that is, out of a hundred subscribers, 12 to 18 are able to call at the same time.

All-Cable System in Holland

The number of rivers and canals in Holland were the cause of the Telegraph Direction using nothing but cables instead of overhead lines. A cable ring line goes via Amsterdam, The Hague, Rotterdam, Utrecht, back to Amsterdam. Another ring line is planned in the southern direction from Rotterdam and Utrecht. Trunk-lines to England, Belgium, France and Germany will be connected with these main lines. Because of the short cable distances repeaters will only be used as exceptions.

The Western Electric Company and Siemens in Berlin have supplied the cables which have been installed. The double lines are connected as four-wire lines. Pupin cables with large copper conductors were employed, the coils of which are inserted 1.44 to 2 miles apart. Although the construction of American and German cables differ, the results of their outputs are about the same. The problem which is of greatest importance for practical use, namely, how to prevent cross-talk between side circuits and four wire lines, was very well solved by both the firms. Siemens used additional condensers for balancing, the Western Electric Co. made the lines in the coil fields cross-over three times.

Ericsson Automatic System Finds Favor in Sweden

The Swedish Telegraph Direction intends to change over to automatic telephone service and is, at present, automatizing the large telephone exchanges in Stockholm and Gothenburg. As soon as they have proved to be good at service automatic telephones are to be introduced for general use.

The automatic system of Ericsson is being employed. It consists in short of the following things: Each subscriber is connected with one relay in the telephone exchange. These relays connect the subscribers with the selectors for the required contacts. The selector call registers, find the wanted numbers and make the contact-making apparatuses do their work. In an exchange with 10,000 subscribers there are 20 switching boards each having 500 circuits. For instance, for a frequency of conversation of 5% it must be possible to connect 25 circuits of each switching board with the contact-making apparatus of the central board at the same time, so all in all there must be 500 change over apparatuses. The contact-making apparatuses of each switching board are connected in groups with the circuits of the central board. The contact-making apparatuses on the switching board are the "circuit selectors," the ones on the central board "group selectors."

Prest-O-Lite

WORLD'S LARGEST MANUFACTURERS OF ACETYLENE AND APPLIANCES. MANUFACTURERS OF AUTOMOBILE, FARM LIGHTING, AND RAILWAY SIGNAL BATTERIES. THE OLDEST SERVICE TO MOTORISTS.

The Speedway Plant at Indianapolis

QUICKER *and* BETTER

A linesman or cable worker to do a good job quickly must have a concentrated, easily-controlled heat at his command at all times.

The Prest-O-Lite Linesman's Outfit serves this purpose in every way.

With the convenient Prest-O-Soldering Iron in his hand and a small Prest-O-Lite Tank strapped to his back, the workman is ready to tackle any kind of a soldering or brazing job—at the top of a pole or at the bottom of a man-hole.

It helps him to do his job better and faster—making him a happier and a better workman.

Thirty-five big gas producing plants supply thousands of Prest-O-Lite Exchange Stations scattered all over the country. You can always get a full tank for your empty one and pay only for the gas.

You telephone men will be interested in our folder entitled "Special Linesman's Outfit." Write for folder 80-A.

THE PREST-O-LITE COMPANY, Inc.
INDIANAPOLIS, IND.

New York: 30 East 42nd Street

Pacific Coast: 599 Eighth Street, San Francisco

In Canada: Prest-O-Lite Company of Canada, Ltd., Toronto

Prest-O-Lite

The Gas of a Thousand Uses

A New Transformer

Kellogg Makes Extensive Tests Resulting in Development of New Audio Frequency Unit

"It is usually the amplifying transformer that determines whether the received programs will be music or noise, for quality in radio music depends largely upon the characteristics of the audio-frequency transformers employed."

With these pre-determined facts in mind, the engineers of the Kellogg Switchboard & Supply Co. were given the problem of producing an audio frequency transformer which would accurately repeat music and speech. It was determined by their tests with all types of transformers available that no one had solved the problem of **true** reproduction through an audio frequency transformer, says a Kellogg press statement.

The difficulty involved in designing an audio frequency transformer was found to be a problem of providing a transformer that would function equally as well on the low (or bass) voice, as on the high frequency (or 5th position of the violin).

Experts on both sides of the continent were interviewed with the idea of obtaining from them some valuable data. Universities, where very delicate testing apparatus is available, were also called upon to assist. Kellogg explains its transformer as follows:

"Figure '1' shows the winding that was finally developed, and found to be the one most efficient for Kellog transformers. Its problems involved the finding of the proper thickness of paper, the proper kind of insulated wire to provide the correct number of ampere turns, and impedance.

"Figure '2' illustrates the one piece laminations of silicon steel, showing the lack of punched holes, which in many other transformers causes eddy currents and losses. This one piece lamination is exclusively a feature of the KELLOGG transformer. It provides an exceptionally true electromagnetic core. The steel is a special thickness and undergoes special chemical analysis.

"Figure '3' illustrates the enameled brass housing or shielding. To correctly shield these transformers that they may be mounted in any position desired without losses, this brass shield was designed. It is so arranged that both sides are inter-changeable, locking together at the base.

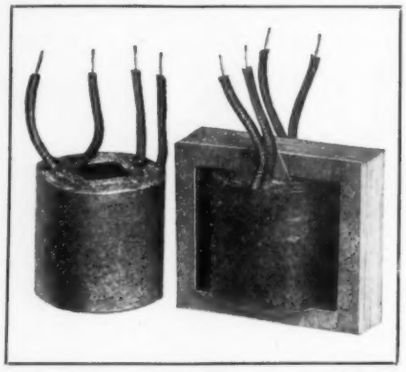


Fig. 1.—Winding developed for Kellogg transformers. Fig. 2—One-piece laminations of silicon steel

"Figure '4' shows the assembly with the top panel and leads extended for soldering. Note that all provisions have been made to protect these leads against breakage by soldering them to the terminals in plain sight where they may be inspected. Many transformers today with enclosed terminals are soldered with soldering paste, which in time causes deterioration and 'opens.' This is entirely overcome in the KELLOGG transformers.

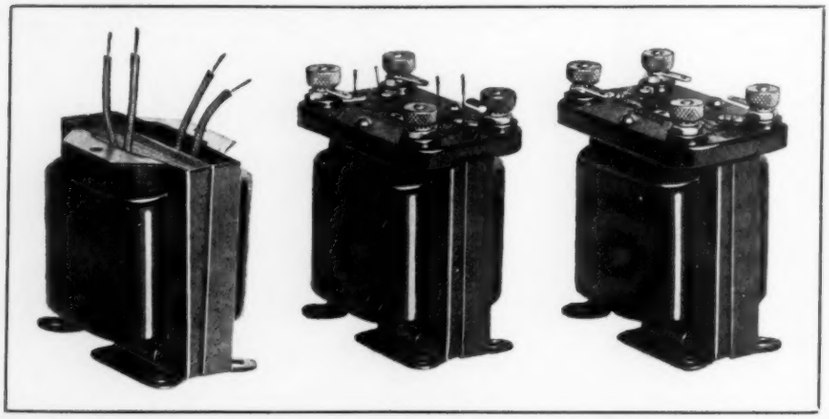


Fig. 3—Enamel brass housing or shielding. Fig. 4—Assembly with the top panels and leads. Fig. 5—The complete transformer

"Figure '5' shows the complete transformer with leads trimmed and soldered to punched and tinned terminals, which are under the nickel plated knurled screw heads, complete and ready to be installed in your set in short order.

"Each binding post is plainly marked so that it is impossible to make incorrect connections."

Three Years to Rehabilitate Japanese Telephone Service

Washington, D. C.—Rapid progress has been made, according to the Japanese press, in the re-establishment of telegraph service throughout the earthquake area, stocks of telegraph wire at Osaka and Shibaura being available for immediate use in repairing the damaged lines. The telephone system, on the contrary, has suffered severely and its complete restoration will require at least three years, says advices to the Far Eastern Division of the Department of Commerce.

In the Fukagawa and Honjo wards, which were completely devastated by fire, it was found that the underground wires and cables had sustained only a limited amount of damage, so that the restoration of this section will be accomplished in a shorter period than was expected.

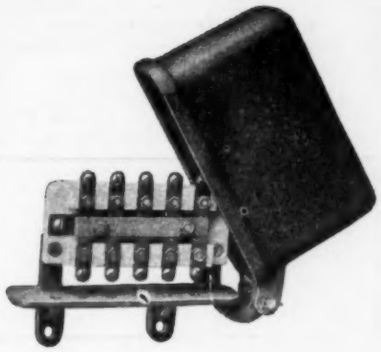
The telephone exchanges at Koishikawa, Aoyama, Ushigome and Yotsuya, serving altogether about 20,000 telephone users, have been reopened since September 29. These four exchanges were saved from the conflagration, though the Yotsuya office was badly damaged. The telephone authorities expect to open a big exchange in a central section of the city next spring, increasing the number of phones by about 10,000. This is, however, a makeshift arrangement, the permanent measures for a complete restoration of the communications system having been left for determination after the main city reconstruction program is settled. At the same time it is said that the manual system hitherto used will be supplanted by an automatic system, so that an unusual opportunity exists in Japan at the present time for the introduction of American-made automatic telephone equipment.

Cooper Wilkins, National Carbon Manager, Convalescing

Louisville, Ky.—Cooper W. Wilkins, National Carbon Co. Chicago manager, who recently was stricken with paralysis while attending a convention at Buffalo, N. Y., is rapidly regaining his health at the Norton Infirmary here. Wilkins has a host of friends in the telephone industry who are very hopeful of his complete and quick recovery.

Mount Holly, N. C.—Extensive improvements in the local plant of the Piedmont Telephone Co.

Stops Loss of Cable Pairs



Drains Wires of Lightning Without Attention

No. 202 SELF CLEANING SAWTOOTH LIGHTNING ARRESTER

Stops open wire leads from carrying disruptive currents into cables

Reliable Electric Company

3145 Carroll Avenue, Chicago, U. S. A.

East Texas District Is Lively Success

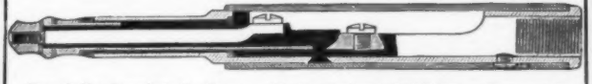
Tyler, Tex.—More than 100 telephone officials and operators attended the initial operators' traffic conference for East Texas held here. Oscar Burton, assistant manager of the Gulf States Telephone Co. of Tyler, acted as chairman.

Representatives were here from Dallas, Tyler, Greenville, Fort Worth, Longview, Terrell, Mexia, Corsicana, Paris, Rusk, Alto, Cookville, Athens, Mineola, Gatesville, Big Sandy, Jacksonville, Wills Point, Canton and Grand Saline. The conference was largely attended, despite inclement weather, and was declared a success from every angle.

The program follows:

"Christmas and Purposes of Conference," by R. B. Still of Tyler, president of the Texas Independent Telephone Association; "Economical Use of Toll Circuits," by Sam Shutt of Waco, general superintendent of the Texas Long Distance Telephone Co.; "Problems of the Tributary Operator," by Mrs. L. Dixon, chief operator, Grand Saline Telephone Co.; "Proper Co-operation Between Toll Centers and the Tributary Office," by Miss Elizabeth Harlee, chief operator, Southwestern Bell Telephone Co. of Corsicana; "Some Observations on Handling Calls at Large Toll Centers," by Miss Etta Mooneyhan, chief operator, Southwestern Bell Telephone Co., Dallas; "Ways and Means of Completing Toll Business," by Miss Virginia Duncan, chief operator, Greenville Telephone Co.; "Overlap Ringing," by Mrs. Kate McManus, chief operator, Athens Home Telephone Co.; "Constructive Criticism," by Mrs. J. N. Hopper, chief operator, Gulf States Telephone Co. of Gatesville.

Short discussions followed each paper and at the close Judge Lindsey made Tyler's bid for future meetings.



Specially insulated plugs. U. S. Patent 1302471. In use in five continents. Prices c. i. f. any place.

TELEFON FABRIK AUTOMATIC
7. AMALIEGADE COPENHAGEN DENMARK

Western CEDAR POLES Northern
TREATED or PLAIN
PENTREX A SPECIALTY
Main Office: NATIONAL POLE CO., Escanaba, Mich.
BRANCH OFFICES { 220 Broadway New York | 2844 Summit Street Toledo, O. | Rialto Building San Francisco, Cal.

CEDAR POLES
NORTHERN + WESTERN
BUTT-TREATING - GUARANTEED GRADES
ANY SPECIFICATIONS REQUIRED
BELL LUMBER CO., Minneapolis, Minn.

"REBUILT" TELEPHONE APPARATUS and exchange equipment saves you 30 to 50 per cent without sacrificing quality or efficiency.
SWITCHBOARDS—Telephones—Apparatus—Protection Equipment—Cable—Everything you need for the installation and operation of a complete exchange—Magneto or Central Energy—of the best and most reputable manufacturers.
Fourteen years' successful operation of our rebuilt equipment department puts it past the experimental stage. Quality and price will make you a permanent customer. Better investigate.
BARGAIN BULLETIN NO. 78 FREE
Address "REBUILT" EQUIPMENT DEPARTMENT
Premier Electric Company 1800-4 Grace St. Chicago, Ill.

Nebraska to Have Big Meeting at Omaha, Feb. 12-14

Omaha, Neb.—Nebraska telephone men are being invited to send in program suggestions to the sessions of the Nebraska Telephone Association's meeting at Castle Hotel, Omaha, Feb. 12-14, which will cover topics of interest and importance to all present.

It is expected that exhibits of the dealers and manufacturers will be larger and of greater interest than those at any previous convention.

The association is anxious to receive expressions of ideas and suggestions from its member companies as to the future work to be undertaken. The expansion of the business in Nebraska is constantly bringing to light new problems and conditions which require careful study and analysis, and a discussion of these problems would be of considerable benefit to all companies.

The convention program committee, which consists of President C. L. Kelly and Secretary-Treasurer A. W. Forbes, has arranged a real entertainment program, full of unusual features, which alone will be worth going miles to attend. Hotel reservations can be made now by dropping a postcard to Secretary Forbes at Stanton, Neb.

Will You Install Cable This Season?

One of our patrons asks for the names of different telephone companies who are planning to install cable this season, especially in the south. Send particulars to TELEPHONE ENGINEER, 28 E. Jackson Blvd., Chicago.

Ohio Telephone Construction Co.
R. E. THOMPSON, Manager
ADA, OHIO
Outside Plant and Underground Construction
Plant Engineering, Aerial and Underground Cable Construction (Burying of Cable), Switchboards, Main Frame and Power Boards and Clearing of Cable Troubles.
References, and List of Exchanges we have built, will be furnished on request.

All Kinds of Printed Forms for Telephone Companies
Monthly Audits
General Accounting Systems Installed
Simplified Accounting for Small Companies

Every State in U. S. represented among our satisfied customers.
Bowdle Accounting System
CERRO GORDO, ILL.

Charles W. McKay
Consulting Telephone Engineer
Valuations — Rate Cases — Plant Problems
Manager, Valuation Division
The Roberts-Pettijohn-Wood Corporation
646 North Michigan Ave., Chicago, Ill.

J. G. WRAY & CO.
Telephone Engineers
Specialists in Appraisals, Rate Surveys, Financial Investigations, Organization and Operation of Telephone Companies.
J. G. Wray, Fellow A. I. E. E.
Cyrus G. Hill
1217 First National Bank Bldg., Chicago

TELEPHONE ACCOUNTING
"COFFEY SYSTEM"
The Independent Standard
Coffey System and Audit Co., C. P. A
607 Peoples Bank Bldg., Indianapolis, Ind.
Exclusive Telephone Accountants

CARLTON G. VAN EMON
Telephone Accountant
We make it our business to look after the interests of our telephone clients here in Washington. A high grade Federal Tax Service at a very reasonable price.
921 Fifteenth Street N. W., Washington, D. C

Valuations—Supervision—Plant—Inductive Interference—Expert Administrative Counsel for Utilities
JAY G. MITCHELL
TELEPHONE ENGINEER
Member A. I. E. E.
1042 W. Monroe St. Springfield, Ill

$37.50
Addressograph

CHEAPER than typewriter—SAVES 20% of YOUR present costs — 5 to 15 times FASTER and BETTER than pen or typewriter.
FREE TRIAL will prove it!
Easy Pay't. Terms
No. 780 3-23
909 W. Van Buren St., Chicago, Ill.

WANTED
Wire Chief and switchboard man. Must be familiar with Western Electric No. 1 Automanual boards and North Electric Automatic apparatus.
The Sidney Telephone Company, Sidney, O.

STEPHENS
CLIMBERS
Straps, Belts and Safetys
W. H. BUCKINGHAM
BINGHAMTON, N. Y.

New York Telephone Co. Breaks All Records

All records for telephone construction in Greater New York and elsewhere in the territory served by the New York Telephone Co. were broken in 1923, which witnessed a gross expenditure of $79,000,000, for new land, buildings, plant and associated apparatus, resulting from a growth in the company's system unprecedented in any previous year. In New York City there are now more than 1,175,000 telephones served by 129 central offices, as compared with 1,071,850 telephones, served by 114 central offices a year ago.

Bell Buys System in Montgomery County, Ohio

The lines of the Montgomery County Telephone Co. at Miamisburg, West Carrollton and other towns in that Ohio county, have been sold to the Ohio Bell. John T. Barlow was president of the company.

New System to Be Built in Missouri

A new telephone system is projected by John C. Harlin, president of the Bank of Gainesville, Gainesville, Mo.; B. F. Wood of West Plains, Mo., and W. R. Kellett, of Bakersfield, Mo.

Wellington Buys Part of Oberlin Plant

The public utilities commission has authorized the Wellington Telephone Co. to purchase the properties of the Oberlin Telephone Co. in Pittsfield township, Lorain county.

PEERLESS Automatic Water Stills
Absolutely pure water for less than one or two cents a gallon, no matter how polluted your supply of water may be. For drinking, chemical or battery purposes the Peerless stills give you the best, ample supply at lowest cost.
Operated without attention other than occasional cleaning.
Write for complete details
SPARTA MFG. CO.
111 S. Hill Street South Bend, Ind.

Everstick
The standard anchor of companies whose engineering practice is standard for the industry.
Telephone companies of every size are using EVERSTICK Anchors because they are the best value in the world for holding hard and fast and for ease of installation.
Write for Details
Everstick Anchor Co.
ST. LOUIS, MO.